IDENTIFYING TEXAS LANDOWNERS' PREFERRED COMMUNICATION CHANNELS, MOTIVATIONS, AND BARRIERS TO ADOPTING BEST MANAGEMENT PRACTICES RELATED TO WATERSHED BASED PLANS

A Thesis

by

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ABSTRACT

This study assessed Texas landowners' preferred communication channels and barriers to and motivation for water quality best management practice adoption. Data was collected from 275 landowners in the Little River watershed in Texas. Results show that landowners prefer to receive information regarding water quality levels, specific conservation practices, and policy information, through direct mailings, four times a year. They currently receive water-related information from industry groups, government agencies, and friends and neighbors, but have higher trustworthiness in Texas A&M AgriLife Extension, Texas Parks and Wildlife, and industry groups. Overall, landowners were influenced by economic profitability, improving land for future generations, and their personal values and connection with the land to adopt best management practices. Landowners reported barriers to adopting best management practices to include the following: being unsure of government regulations, initial costs of implementing practices, maintenance costs, lack of information about effectiveness of practices, and a lack of information about incentive programs.

DEDICATION

I dedicate this thesis to myself and my family. I am proud of the long hours and hard work that I have put into this. I have learned so much about research, myself, and my ability to persevere through hard times to reach my goals. I have grown so much, I am proud of you, Stacey.

The drive to accomplish tasks I put my mind to is a trait learned through my family's values and rearing. My passion to help landowners and the environment stem from my family's value to be good stewards to God's land. My parents have supported me throughout this process even when they did not understand what I was doing. Their support and encouragement was more than I could ask for.

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All other work conducted for the thesis was completed by the student independently.

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NOMENCLATURE

BMP	Best Management Practice
WBP	Watershed Based Plan
WQMP	Water Quality Management Plan
EQIP	Environmental Quality Incentives Program
CRP	Conservation Reserve Program
LIP	Landowner Incentive Program

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION

Background

Balancing agricultural production and healthy waterways is important to the future of mankind and the environment. By 2051, the population of America is projected to reach 400 million people, up from the 319 million documented in 2014 (Colby & Ortman, 2014). With this large population growth, global crop yields of agricultural commodities, such as wheat, rice, and soybeans, must double by 2050 to meet the demands of the human population (Deepak, Mueller, West, & Foley, 2013). The increase in production demand for agricultural commodities has been the leading nonpoint source of pollution for U.S. rivers and streams and is the second largest source of impairments on wetlands (Centers for Disease Control and Prevention (CDC), 2010; Environmental Protection Agency (EPA), 2016a). Yet, adequately suppling American citizens with food and a healthy sustainable environment requires a non-polluting relationship between agricultural production and waterways.

Across the United States, an estimated 920 million acres is privately owned farmland, and landowners make their own land management decisions (U.S. Ag Census, 2012a). As landowners increase production in the next 34 years, they should consider the impact their land management decisions have on waterways and should consider water pollution when making land management decisions. Privately or publicly owned land

areas (e.g., rivers, streams, lakes, agricultural land, municipal areas, and underground water) are part of a watershed (United States Department of the Interior, 2016).

Watersheds are "area[s] of land that contribut[e] runoff to a lake, river, stream, wetland, estuary, or bay" (EPA, 2008, pp. 1-2) and gather moisture from rain and snowfall. As moisture gathers in a watershed, it naturally runs into existing bodies of water through a funnel-shape created by the natural contouring of land in a given area (Unites States Department of the Interior, 2016). Water is naturally purified through soil filtration by forests and grasslands as it moves through a watershed (Iowa Department of Natural Resources, n.d). At the same time, during water's movement through the watershed, it picks up nonpoint source pollution from agricultural practices that disturb soil structure, urban development, and industrial waste, affecting the quality of water throughout the watershed (Guo, 2014; Iowa Department of Natural Resources, n.d.; National Oceanic and Atmospheric Administration, 2015; United States Department of the Interior, 2016). These sources of pollution create potentially unsafe rivers and streams which are used for recreational or potable purposes and affect the human, animal, and environmental ecosystem.

To protect the quality of the nation's watersheds, natural resource conservation agencies and others across the United States are working together to create acts and initiatives and issue grants and incentive funding which support behavior that can improve water quality. The USDA's Natural Resource Conservation Service promotes the National Water Quality Initiative, which works closely with environmental organizations and on-the-ground partners, such as state, regional and county

conservation agencies, to “select priority watersheds where on-farm conservation investments will deliver the greatest water quality improvements” (USDA, n.d.b, para. 2). Other environmental organizations, such as the Nature Conservancy, also work with on-the-ground partners to prevent, restore, and create healthy water environments (The Nature Conservancy, n.d.b). Additionally, the EPA allocated $163.4 million in 2016 to their Section 319 Nonpoint Source Management Program to provide funding to on-the-ground organizations who allocate funding for local landowners (EPA, 2016b). Through the financial funding from natural resource conservation agencies and others, landowners can minimize the upfront cost of implementing best management practices (BMP) to reduce pollutants from entering waterways. BMPs (e.g., buffer strips, prescribed grazing, and critical area plantings) are helpful in mitigating waterway pollution (USDA, n.d.a).

To aid in awareness of financial funding or incentive programs, water-related information, and the improvement of watersheds, watershed-based plans (WBP) should be created. WBPs are an organized document of steps, goals, measurements, and educational objectives to improve the quality of water in watersheds (EPA, 2008). The EPA (2008) suggested the following procedure to create WBPs.

According to the EPA (2008), to begin developing a WBP, partnerships are created among environmental organizations, regional and on-the-ground agencies, and landowners to identify the water pollution and environmental issues in specific watershed areas. These partnerships are developed to encourage support, ideas, and assist in carrying out the WBP. As a starting point, data related to water pollution levels

of the watershed is gathered and potential sources of the pollution are identified. After stakeholders finalize goals and determine potential solutions, proper incentive programs and BMPs are identified to achieve the goals set in the WBP. The next step is to design the implementation plan which includes setting schedules, timeline goals, evaluation processes, and developing technical and financial assistance to implement the plan. At the end of the process, a formal WBP document is created. To implement the WBP, plan developers inform the public through communication and education endeavors. Water-related information, BMPs associated with the plan, and updates of the management process are delivered to the public. Throughout the process of implementing the plan, water data, including pollution levels, are documented and the effectiveness of the plan is reviewed. From there, adjustments are made to improve the success of the plan. Continuous evaluations and adjustments take place throughout the implementation of the plan and the measuring of progress to ensure the goals of the plan are achieved (EPA, 2008, p. 2-5 – 2-6).

One way landowners are informed about BMP implementation and funding is through agency meetings. For example, the Texas Parks and Wildlife Department helps the USDA by hosting informational meetings about Farm Bill programs benefitting soil, water, and wildlife, such as the Private Lands Program (Campbell, n.d.). Those programs and practices, which are encouraged by the Texas Parks and Wildlife Department, assist in accomplishing the goals listed in WBPs. Figure 2 shows an organized conceptual model of the process for creating WBPs (EPA, 2008, p. 2-5 – 2-6). By establishing an

overarching management plan, environmental organizations, on-the-ground agencies, and landowners can work together to improve watershed quality.

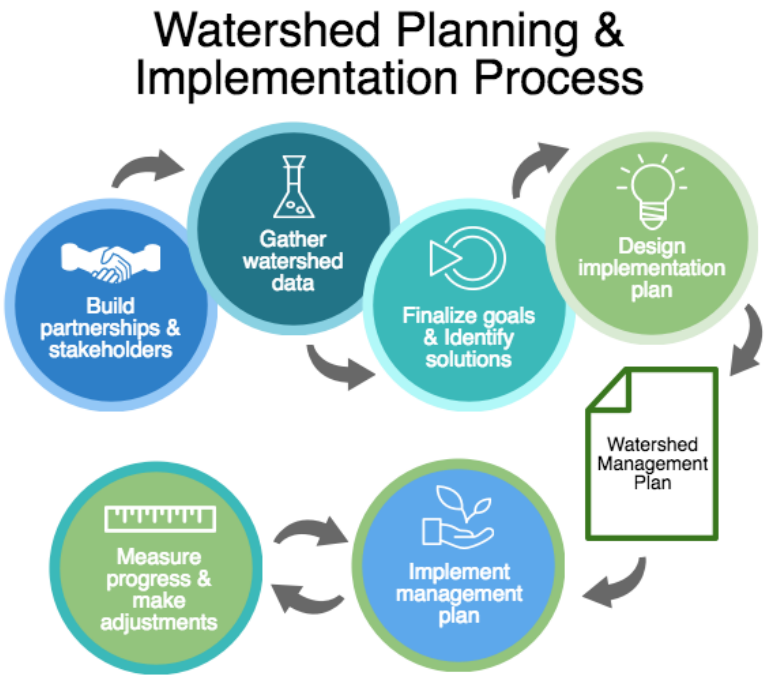

Figure 1. Suggested process of creating a watershed based plan. Adapted from EPA (2008, p. 2-5 – 2-6).

Water Concerns in Texas

Although agricultural activities have been documented as the leading cause of water pollution in the United States (EPA, 2016d; CDC, 2010), Texas landowners perceived industry waste, storm water runoff, and new suburban development as the main contributors of water pollution in Texas (Boellstroff, McFarland, & Boleman, 2010). In Texas, "bacteria is the No. 1 pollutant of water …, causing many of the state's water bodies to be placed on the Texas Water Quality Inventory and 303(d) List for

failing to meet contact recreation use standards" (Foust, 2010, para. 1). Based on the water quality standards set forth by the Texas Commission on Environmental Quality (TCEQ), recreational use in tributaries of the Little River watershed in Texas are impaired from elevated levels of bacteria (TCEQ, 2014b). A geomean (i.e., geometric mean), or estimate of median, over 126 is classified as exceeding the primary recreational standards for human use. Recreational human use includes activities (e.g., swimming, boating, etc.) that could possibly lead to human ingestion of contaminated water (TCEQ, 2014b).

Covering three Texas counties (i.e., Bell, Milam, and Falls) the Big Elm Creek and San Gabriel River are tributaries of the Little River (Figure 3; TWRI, 2016), a tributary to the Brazos River. The Little River has a bacteria geomean of 135 exceeding TCEQ's (2014a) criteria.

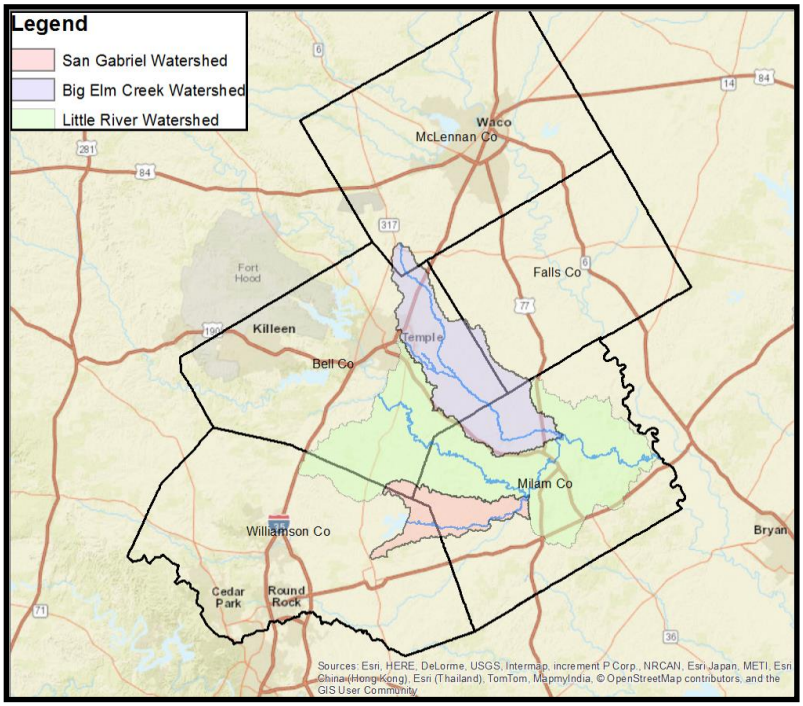

Figure 2. Map of Little River, Big Elm, and San Gabriel tributaries across Bell, Milam, and Falls counties (TWRI, 2016). Adapted with permission from T. A. Berthold, Texas Water Resources Institute.

Theoretical Framework

Rogers (2003) suggested individuals who adopt a new idea, such as a BMP, go through an Innovation-Decision process. The first stage of Rogers's (2003) process was knowledge, occurring when individuals gain an understanding of the problem or the innovation. How can landowners implement a solution if they do not know there is a need/problem or that there is even an option to implement a solution? Rogers (2003) indicated "individuals do not always recognize when they have a problem," (p. 172) and, Heath and Heath (2010) suggested "what looks like resistance is often a lack of clarity"

(p. 17). The idea of individuals not adopting an innovation, such as BMPs, could possibly stem from a lack of clarity or being unaware of the problem.

To begin understanding landowners' knowledge and communication preferences to encourage adoption, a more accurate and specific evaluation of landowners' perceptions is needed to deliver effective water-related information in accordance with WBPs. Educators and communicators, such as on-the-ground agencies, need to understand landowners' views about water-related topics and the social pressures and motivations to implement practices that will protect water resources (Bollestroff et al., 2010). Guo (2014) noted that understanding landowners and gathering feedback from them is important when making adjustments to the development and delivery of WBPs.

Purpose and Objectives

The purpose of this study was to identify landowners' preferred communication channels for receiving information related to WBPs and motivations for and barriers to adopting BMPs related to WBPs. The purpose was achieved using two research objectives and five research questions.

1. Describe landowners' preferences for receiving information related to WBPs.
    a. How do landowners prefer to receive water-related information?
    b. What sources of water-related information do landowners trust?
    c. What types of water-related information do landowners prefer to receive?
2. Describe landowners' motivations for and barriers to adopting and implementing WBPs.

a. What factors motivate landowners to adopt and implement BMPs related to water quality?
b. What barriers keep landowners from adopting and implementing BMPs related to water quality?

Significance of Study

Tributaries of the Little River watershed (i.e., Big Elm Creek) under investigation are failing to meet recreational water use standards set by TCEQ (2014). This study provided stakeholders (e.g., natural resource conservation agencies) within the area with information about how to effectively disseminate water-related information that encourages landowners to adopt BMPs and to improve water quality in the watershed.

CHAPTER II

COMMUNICATION OF WATER-RELATED INFORMATION TO TEXAS LANDOWNERS IN THE LITTLE RIVER WATERSHED

Introduction

Pollution is impacting the quality of American waterways and affecting the aquatic species, animals, humans, and ecosystems that depend on it. The National Rivers and Streams Assessment of 2008 and 2009 showed 46% of the 1.2 million miles of United States rivers and streams were in poor biological condition (EPA, 2016e). The possible source of unsuitable habitat could be traced to agricultural practices, which are the leading non-point sources of pollution of the nation's waterways (CDC, 2010). Nonpoint sources are considered pollution sources picked up by rain, snowfall, or drainage and deposited into the ground or bodies of water (EPA, 2016a). Nonpoint source agricultural activities include poor management of animal feeding operations, extensive plowing, and poor management of pesticide and fertilizer application (CDC, 2010).

Agricultural land, as well as municipal areas, and waterways, also contribute to nonpoint source pollution because they are part of a watershed (United States Department of the Interior, 2016). Watersheds are areas of land that gather moisture from rain and snow and contribute it to waterways such as lakes, streams, and wetlands (EPA, 2008; United States Department of the Interior, 2016). Along with gathering moisture, watersheds carry pollutants that end up in waterways. These waterways are monitored for pollution by state, federal, and local agencies, including universities, in

order to determine water quality and evaluate the health of watershed conditions (EPA, 2013). To reduce pollutants entering waterways from upland sources, such as privately owned agricultural land and municipal areas, BMPs (e.g., buffer strips, critical area planting, and storm water runoff control) can be implemented (Iowa Department of Natural Resources, n.d.; USDA-NRCS, n.d.a).

WBPs support the implementation of BMPs and are created by stakeholders, including environmental organizations, agencies, and landowners. A WBP is a document that contains steps, goals, and educational objectives to aid in improving water quality in a specific watershed (EPA, 2008). Public education and participation are included in WBPs to address nonpoint source pollution (Kaplowitz & Lupi, 2012). Although WBPs are useful to reduce pollutants from entering waterways, these plans sometimes lack strategies for successful delivery of water-related information and education about BMPs. Thus, agricultural landowners may be unaware of water quality issues and miss opportunities to implement BMPs. The lack of successful delivery of WBP information could be caused by poor delivery of the information, lack of trust in information sources, or the type of water-related information delivered.

Preferred Communication Channels

"Access to and quality of information" has a strong impact on the adoption of BMPs (Baumgart-Getz, Prokopy, & Floress, 2012), and could be considered a barrier to adopting BMPs. Landowners who are unaware of information about BMPs or cannot access this information would have no opportunity to implement the BMP. Although many communication channels (e.g., television, newspaper, direct mailings, newsletters,

magazines, radio, email, websites, social media) are available to the public, many landowners are often unaware of information that is available to them or how to access it (Molnar, Bitto, & Brant, 2001).

Previous research has found newsletters are a highly preferred method of communication because they are a "quick, convenient, and non-invasive method of getting information" (Rosenberg & Margerum, 2008, p. 488). For example, landowners across four selected watersheds in Michigan preferred printed communication materials such as newsletters, printed bulletins, and fact sheets for receiving information about water conservation practices (Howell & Habron, 2004). Furthermore, Boellstorff et al., (2010) noted that 45% of Texas farmers and ranchers reported they have previously received water quality information from newspapers and magazines.

However, White, Meyers, Doerfert and Irlbeck (2014) found individuals involved in agri-marketing use social media to communicate about current agricultural issues, such as water quality, to educate the agricultural community. Additionally, agricultural organizations use blogs to inform both traditional and new audiences about activities, events, and news that are specific to their organization (Moore, Meyers, Irlbeck, & Burris, 2015). Internet and social media communication channels have changed the way landowners receive information related to agriculture, away from more traditional communication channels such as direct mailings, newspapers, and magazines.

Furthermore, in 2000, Thysen noted email was important to the future of agricultural extension services and the agricultural network. Access to wireless Internet, including email, provides landowners the opportunity to gain access to educational

information and make real-time decisions on their farm (Thysen, 2000). Additionally, Tuffle Media Networks (2012) found 20% of male participants between the ages of 50 to 60 believed newsletters were the most valuable communication tool, which was drastically different than the 78% of participants who believed email was more valuable.

Yet, in the last 12 to 15 years, information delivery has changed drastically. For example, the Pew Research Center and Caumont (2013) found 50% of Americans obtain national and international news and information using the Internet. Of those same participants, 60% reported using television to obtain news and information. Furthermore, Moore (2012) found agricultural organizations used blogs to connect with the public on "messages about current events, consumer information, industry news, travel and to educate various public about production agriculture" (p. 117). To further support the use of social media, Cline (2011) noted 93% of respondents, who were predominately Caucasians who "have worked or lived on a farm or worked for an agricultural business" used social media to access agricultural information and participate in media conversation (p. 81). Thus, agricultural organizations use social media to diffuse information to and connect with landowners. Not only are the communication channels landowners use to access information important, but frequency of receiving information is also important. For example, Cline (2011) found participants spent roughly six hours per week on social media sites for agricultural purposes. The amount of time individuals spend on social media is relevant to information distribution and can impact the frequency by which information could be delivered.

Trustworthiness of Sources

Individuals who access information via newspapers, television, and online communication channels consider timeliness and up-to-date information credible and prefer news and information to be trustworthy, accurate, unbiased, and honest (Abdulla, Garrison, Salwen, Discoll, & Casey, 2002). Credible sources of information can include agencies, organizations, and businesses, such as governmental agencies, environmental groups, and local university Extension offices as individuals seek out like-minded people or organizations for agricultural-related information (Cline, 2011).

An individual's decision to pay attention and absorb the messages from such sources can depend on their perception of the sources' trustworthiness. For example, research by Mase, Babin, Prokopy, and Genskow, (2015) suggested landowners across 19 watersheds in the Midwest reported to trust local university extension, soil and water conservation districts, and natural resources conservation service more than environmental organizations and lawn care businesses. However, Rosenberg and Margerum (2008) found landowners in Oregon watersheds have little trust in county, state, federal governmental agencies, and industry representatives as information sources when encouraging adoption of conservation practices. How trustworthy a landowner views a source of information can greatly impact how effectively education and promotion of BMPs are diffused to landowners in a specific watershed.

Trustworthiness for organizations and government agencies can be difficult to gain from individuals. Hardin (2013) explained people often distrust the government because of the ambiguity or uncertainty they feel. Ambiguity occurs when information is

not easily transparent or not easily accessible to individuals. To reduce distrust and ambiguity, Kaplowitz and Lupi (2012) found that including landowners and individuals in the decision making process of WBPs, especially when determining which BMPs to implement, can positively impact the adoption of the practices. This can be attributed to the transparency and accountability of all decision makers, including governmental and environmental agencies (Giupponi & Sgobbi, 2008). Furthermore, this believed transparency supports the idea of individuals' perceptions of source trustworthiness.

Friends, families, neighbors, and local university extension agent services were considered more trusted sources of information, than environmental or government agencies in a study by Rosenberg and Margerum (2008). Furthermore, the relationship between landowners and their friends, family, neighbors, and/or extension agents can possibly be attributed to interpersonal communication, which is considered an important factor in trustworthiness related to adoption. Rogers (2012) explained that, although mass media can be useful when diffusing information to a large number of people, interpersonal channels (e.g., face-to-face exchanges) are "more effective in persuading an individual to accept a new idea" (p. 18). Similarly, Morton, Bitto, and Brant (2001) suggested that some encouragement of participation in conservation practices may require one-on-one interactions. Walter (2010) stated, "farmers are best able to encourage other farmers to become involved in watershed quality projects, and able to set examples by implementing management practices" (p. 3). Interpersonal communication, such as this, with friends, family, and neighbors can be a good

foundation for the sharing of examples and stories of landowners' personal experience with implementing a practice.

The importance of interpersonal communication was further supported in 2010 when 35.1% of landowners in Texas said the conversations they had with other people encouraged them to change their minds on environmental issues (Boellstorff et al., 2010). Face-to-face communication strategies, such as farm meetings, workshops, field days, etc. are a preferred source of communication about watershed conservation (Howell & Habron, 2004). This finding reveals the power of face-to-face conversations and documents that sharing of experiences can build trust and bring about change.

Preferred Messages

To further encourage individuals to gain knowledge about water-related topics, the information delivered to landowners should be appealing and interesting. "Education and outreach approaches centered only on the environmental dimensions of conservation projects may be insufficient to motivate changes in conservation behavior" (Jackson-Smith & McEvoy, 2011, p. 341). Environmental dimensions can include general facts about water such as how the production of agricultural commodities can impact water quality or identifying a waterway's current water quality levels (e.g., nutrients, salinity, etc.). Guo (2014) suggested that messages which express the positive impacts of implementing conservation practices can encourage adoption. Such positive impacts of implementing BMPs include landowners' economic gain, property improvement, and environmental improvement for future generations.

The use of positive messages regarding BMPs is supported by Baumgart-Getz, et al. (2012) who suggested educational efforts should focus more on how landowners' actions can impact water quality, rather than addressing how agricultural practices negatively impact water quality. This suggests that water-related messages should not, for example, include the declining water quality, but instead focus on how landowners' actions impact water quality. Providing such action-type information, such as how a conservation practice reduced erosion, can be beneficial to influencing the adoption of BMPs. Morton (2011) explained that experts and scientists of environmental practices often suggest the adoption of conservation ideas that are not meaningful and do not relate to the landowners' own situation. Non-relatable information, such as ideas that are not useful or suitable for landowners' management situation or land composition, can lead to landowners not adopting the conservation idea.

Theoretical Framework

The information diffusion theory (Stone et al., 1999) was designed to assist companies and organizations in tailoring communication to the preferences of an audience in order to effectively deliver preferred messages. "Information diffusion deals with news flow from the point of mass media dissemination to the point at which almost all in the population learn about the event" (Stone et al., 1999, p. 166). In the case of WBPs, how water-related information is delivered to landowners is an important aspect to ensure awareness of the entire population.

The information diffusion theory has three major elements: leveling, sharpening, and assimilating (Stone, Singletary, & Richmond, 1999). Leveling, or shortening the

message, allows consumers to clearly understand the information being provided without becoming overwhelmed. Sharpening, or emphasizing key details, provides consumers the most important information. More in-depth information can be provided later, but for immediate mass media purposes, sharpening is critical to providing the most important information first. The third element is assimilation of, or distorting messages to fit, preexisting stereotypes, attitudes, or expectations, allowing the media to provide relatable messages to a specific population.

Tucker and Napier (2002) supported Stone et al.'s (1999) idea of sharp and specific messages by describing doubts in the value of broad-based or "shotgun" approaches for delivering agricultural information. Such approaches entail very broad and general information delivered across many audiences, not specific, or applicable, to a given audience. Furthermore, informational agricultural messages should be short, sharp and tailored to landowners' demographics and psychographics (Morton, 2011; Stone et al., 1999), such as land characteristics and general socioeconomic situations within the target region (Tucker & Napier, 2002). Molnar et al. (2001) suggested that landowners with small amounts of acreage require "simple and direct technical materials to implement core conservation measures" (p. 37), because they rely on clear printed informational materials (Molnar et al., 2001). Tailored information to a specific audience can greatly influence the adoption of BMPs related to WBPs.

Context for Texas Watershed Management

Many Texas waterways are failing to meet recreational use standards because of bacteria – the number one pollutant of waterways in the state (Foust, 2010). Specifically,

the Big Elm Creek is failing to meet standards and contributing bacteria to the Little River and the Brazos River downstream (TCEQ, 2014). Bacteria pollution in the Little River can partially be attributed to the large amount of agricultural production within the watershed. In the combined watersheds, including Big Elm Creek, San Gabriel River, and Little River, about 214,231 acres are cultivated cropland (TWRI, 2016a). Because 93% of the watershed is made up of agricultural land (e.g., pasture, rangeland, etc.), there is a strong need for BMPs to be adopted to reduce pollutants from entering the waterways.

To mitigate the pollution in the Little River watershed, and more specifically Big Elm Creek, the Texas Water Resources Institute of Texas A&M AgriLife and TCEQ are working to develop and implement a WBP. A major task of a WBP is to implement public outreach and education, and encourage adoption of BMPs. Gathering feedback from landowners is important to the development, delivery, and implementation of WBPs (Guo, 2014). An extensive understanding of landowners' communication preferences regarding water-related information.

Purpose and Objectives

The purpose of this study was to identify landowners' preferred communication channels for receiving information related to WBPs. The purpose was achieved using one research objective and three research questions.

1. Describe landowners' preferences for receiving information related to WBPs
    a. How do landowners prefer to receive water-related information?
    b. What sources of water-related information do landowners trust?

c. What types of water-related information do landowners prefer to receive?

Method

The method described herein was part of the reporting for a larger thesis research project, "Identifying Texas landowners' preferred communication channels, motivations, and barriers to adopting best management practices related to watershed based plans" (Dewald, 2016). A complete description of the research method for this study is described below.

Study Design

A quantitative research design was used to identify participants' preferred communication channels (Greiner & Gregg, 2011; Kaplowitz & Lupi, 2012; Rosenberg & Margerum, 2008). Quantitative methodology was chosen because it provided the ability to generalize, establish facts, and statistically describe the population (Bryman, 2012). For example, results of this study sample quantifiably described the preferred communication channels, trustworthiness of sources, and preferred types of information, and factually generalized to the population of the Little River watershed to deliver water-related information. However, quantitative research does fail to provide explanation or further description regarding observations and emotional expression of participants' thoughts (Bryman, 2012).

The survey methodology followed Dillman, Smyth, and Christian's (2014) social exchange theory and encouraged participation through the establishment of trust, increasing benefits, and decreasing cost to the participant. The social exchange theory attempts to earn the trust of the participant, show the benefits of participating in the

study, and describe the rewards of participation (Dillman et al., 2014). For example, logos were used to show legitimacy of the study and return postage was included to encourage participation.

Population and Sampling

The target population of this study was landowners in three Texas counties—Bell, Milam, and Falls—surrounding the Little River, San Gabriel River, and Big Elm Creek. The Little River watershed, San Gabriel River, and the Big Elm Creek have 50,988 acres of developed land; 418,506 acres of pasture or grazing land; 214,231 acres of cultivated crops; 1,269 acres of barren land; and 28,242 acres of wetlands (TWRI, 2016a). The three waterbodies were selected because they are currently, or were previously, impaired by excessive levels of bacteria (TCEQ, 2014b).

In the selected counties, U.S. Ag Census (2012b) reported the average age of Caucasian principal operators of agricultural operations, or individuals who make land management decisions, to be 57.2 in Bell County, 58.4 in Milam County, and 56.9 in Falls County. The average age of women operators was 58.5 in Bell County, 61.9 in Milam County, and 59.5 in Falls County. The average age of Spanish, Hispanic, or Latino operators was 53.5 in Bell County, 52.6 in Milam County, and 53.5 in Falls County. The average age of African American operators as 61.1 in Bell County, 64.7 in Milam County, 62.6 in Falls County. No data regarding the average age of Asian American operators in Bell, Milam, or Falls Counties was available.

Additionally, Caucasian principal operators managed/owned 415,044 acres in Bell County, 512,554 acres in Milam County, and 373,519 acres in Falls County.

Spanish, Hispanic, or Latino principal operators managed/owned 7,207 acres in Bell County, 15,385 acres in Milam County, and 10,971 acres in Falls County. African American principal operators managed/owned 1,983 acres in Bell County, 8,752 acres in Milam County, and 6,383 acres in Falls County. Asian American principal operators managed/owned 489 acres in Bell County, 1,254 acres in Milam County, and zero acres in Falls County (U.S. Ag Census, 2012a). Native Hawaiian principal operators managed/owned zero acres in Bell, Milam, or Falls Counties (U.S. Ag Census, 2012a). Additionally, women principal operators managed/owned 30,890 acres in Bell County, 35,427 acres in Milam County, and 22,344 acres in Falls County (U.S. Ag Census, 2012a). Census data only provides an estimate of demographic and land use data across the target counties because these numbers represent areas that expand outside of the watershed under investigation. The Little River watershed, San Gabriel River, and the Big Elm Creek combined includes 50, 988 acres of developed land, 418, 506 acres of pasture or grazing land, 214, 231 acres of cultivated crops, 1,269 acres of barren land, and 28, 242 acres of wetlands (TWRI, 2016a).

I obtained the target population for this study, a landowner shapefile containing GPS coordinates from the local County Assessor's office in each of the three counties. Using Geographic Information System (GIS), TWRI researchers identified landowners with addresses living outside of city limits and along the three waterways, which resulted in a population of 7,592 names and addresses. A sample was obtained using a simple random sampling method (Bryman, 2015). Using an online sample calculator

with a 95% confidence level and a 1.96 confidence interval, a sample of 1,881 was obtained.

Of the 1,881 questionnaires mailed, 1,880 were deliverable. I had an overall response rate of 25% (N =462) after all four points of contact. During the first round of data collection, participants returned 217 questionnaires. The second round of data collection totaled 245 participants with returned questionnaires. As a whole, 21 participants completed the questionnaire online, and three participants opted out of participating in the study through the online link. A total of 254 participants returned a mailed questionnaire, and 187 participants opted not to participate via a mailed questionnaire. The response rate of usable data was 15% (N =275). Throughout the data collection period, participants who replied not wanting to be involved in the study were removed from the sample mailing list and reported in the response rate. This response rate is typical of water-related research in Texas (Berthold, 2014).

Demographic characteristics of the 275 participants residing in Bell, Milam, and Falls counties are shown in Table 1. Of those 275 participants, 28.4% were 55 to 64 years of age (n = 78), 67.3% males (n = 185), 83.6% Caucasian (n = 230), and 24.0% had a bachelor's degree (n = 66).

Table 1

Demographic Characteristics of Participants in the Little River Watershed who Selected to Participate in the Study Focused on Adoption of BMPs related to Watershed Based Plans (N= 275)

Characteristics	*n*	*%*
Age		
54 or younger	52	18.9
55 to 64	78	28.4
65 to 74	73	26.5
75 or older	55	20.0
Gender		
Male	185	67.3
Female	80	29.1
Ethnicity		
American Indian	1	0.4
Asian	1	0.4
Black or African American	19	6.9
Native Hawaiian or Pacific Islander	0	0.0
Spanish, Hispanic, Latino	3	1.1
White or Caucasian	230	83.6
Highest level of education		
Less than high school	6	2.2
High school diploma/GED	47	17.1
Some college	46	16.7
2 year degree	30	10.9
Bachelor's degree	66	24.0
Graduate Degree	58	21.1
Other	10	3.6

Instrument

I mailed a booklet-style self-administered questionnaire titled "Your perceptions on watershed management in your area" to the sample (*N*= 1,881). A cover letter and information sheet accompanied the questionnaire and informed the participants about the

scope of the study, confidentiality, and the benefits of participating. The questionnaire was designed based on interviews with Texas A&M AgriLife Extension agents in Bell, Millam, and Falls counties; review of relevant literature; and the Social Indicators Data Management and Analysis (SIDMA) tool website (Genskow & Prokopy, 2011). The AgriLife Extension agent interviews helped with understanding the landowners within the watershed and tailor the instrument for relevance and readability. Questions from existing instruments were modified and adapted for inclusion in the questionnaire: "Water issues in Texas: A survey of public perceptions and attitudes about water" (Boellstorff et al., 2010), "Landowner motivations for watershed restoration: Lessons from five watersheds" (Rosenberg & Margerum, 2008), "Factors influencing the adoption of water quality best management practices by Texas Beef cattle producers" (Peterson, 2014), and "Addressing water quality mitigation challenges through evaluation" (Berthold, 2014). Additionally, I adapted and modified questions from the SIDMA website, which is a repository for surveys created to evaluate landowners' environmental concerns related to watersheds. The SIDMA handbook uses the Social Indicator Planning and Evaluation System (SIPES) to guide the structure and basis of question development and helps organizations to design instruments to understand landowners' perceptions of watershed management (Genskow & Prokopy, 2011).

The questionnaire consisted of 24 questions and was presented using a close-ended format. I arranged the questions starting with general agricultural background questions, which included acres owned and/or leased, type of agricultural commodities produced, and numbers of years managing land in agricultural production.

Demographics (e.g., ethnicity, education level, gender, and birth year) concluded the questionnaire. Additionally, at the end of the questionnaire, I provided an optional open-ended question available for participants to provide feedback about WBPs.

Within the questionnaire, a dichotomous scale was used to determine how participants currently received water-related information through nine communication channels (i.e., television, newspaper, direct mailings, email, magazines, radio, books, websites, and social media). Using a modified five-point Likert scale (i.e., least preferred, slightly not preferred, no preference, slightly preferred, and most preferred), participants noted their preference for receiving water-related information. Also, using a modified five-point Likert scale (i.e., monthly, quarterly, twice annually, and never), participants noted how frequently they preferred to receive water-related information.

Using a dichotomous scale (i.e., yes or no), participants noted whether they receive or did not receive information from nine identified sources (i.e., government agencies, industry groups, and agricultural service providers, etc.). Participants also rated the trustworthiness of the nine sources using a modified four-point Likert scale (not trustworthy, somewhat trustworthy, trustworthy, and very trustworthy). To determine the types of water-related information landowners were most interested in receiving, I included 11 statements ranging from "how water quality impacts your operation" to "how to install/maintain conservation practices" to "policies related to water." Participants rated the statements using a modified four-point scale (i.e., not interested, somewhat interested, interested, and highly interested). Using the same 11 statements

and a modified four-point scale (i.e., not needed, somewhat needed, needed, and very needed), participants indicated their level of need for educational opportunities.

I established content validity of the instrument using three main sources (Bryman, 2015). A committee of TWRI content experts who specialize in water resources and have extensive experience in developing WBPs reviewed the instrument for content. Bell, Milam, and Falls county Extension agents also reviewed the instrument and provided feedback regarding the structure of content to increase the likelihood that landowners who received the questionnaire would understand and relate to the questions. Content validity was also obtained through the use of questions from SIDMA website.

I attempted to establish instrument reliability through a pilot test with a sample size of 60. Due to low response rate (n = 3), the pilot test was not used as a source of reliability. Instead, I calculated post-hoc Cronbah's alpha on one question with 11 variables (α = .954).

Data Collection

The questionnaire was mailed to the participants to meet the needs of the perceived preferences of the target population, as suggested by DeVillis (2016). Within the postal contact, participants had the option to complete the questionnaire on paper and mail back, or if interested, use the web-based method. To use the web-based method, participants were given a URL to access an online version of the questionnaire using the Qualtrics software. This questionnaire delivery method, to contact the sample by mail first and provide the option to participate online, was suggested by Messer and Dillman (2011). Bryman (2012) also suggested that providing participants with multiple options

to participate is beneficial. Mailed questionnaires allow participants to complete the questionnaire at their own pace (Bryman, 2012). Although this is an advantage, it can also be a disadvantage in that researchers do not have the ability to monitor the participant and ensure full completion of the questionnaire (Bryman, 2012). No monetary incentive was provided in this study.

The initial postcard was mailed on June 24, 2016, to notify the participants of the study and provide the link to complete the questionnaire online. The first questionnaire was mailed on July 1, 2016. On July 8, 2016, a "Thank You" postcard was sent to those who had participated and a reminder was sent to those who had not filled out the questionnaire. A final questionnaire packet was sent on August 6, 2016, to those who had not completed the questionnaire. Data collection ended on August 12, 2016. A total of 1,881 questionnaires were mailed to the sample. When mailing the postcards, 122 were returned due to various reasons (e.g., addressee not at address, addressee temporarily away, vacant address, closed P.O. Box). Because return postage was not requested for the questionnaire, I cannot ensure the 122 participants received it. Therefore, the 122 were not removed from the sample.

Data Analysis

Data analysis was conducted using Version 23 of the Statistical Package for Social Sciences (SPSS). Following Lindner, Murphy, and Briers (2001), I compared early to late respondents to ensure validity. Among three reliable questions, no significant differences were found between early and late respondents (Lindner, Murphy & Briers, 2001). I calculated descriptive statistics (i.e., mean, standard deviation, and

frequency) on measurable variables and ran *t*-tests on categorical data to determine association among variables, and calculated Bonferroni correction accordingly (Field, 2013).

Results

Landowners' Preference for Receiving Water-related Information

Participants reported receiving water-related information through a variety of communication channels (see Table 2). Direct mailings (*f* = 109, 48.0%) were most frequently reported to be currently received by participants. However, with all of the identified communication channels, participants reported a higher frequency of not receiving water-related information.

Table 2

Participants' Current Use of Communication Channels to Receive Water-related Information (N = 275)

	Yes		*No*		
Communication Channel	*f*	*%*	*f*	*%*	*n*
Direct mailings	109	48.0	118	52.0	227
Magazines	94	41.4	133	58.6	227
Newspaper	92	40.2	137	59.8	229
Television	89	38.2	144	61.8	233
Websites	85	37.8	140	62.2	225
Email	56	24.9	196	75.1	225
Radio	49	21.8	176	78.2	225
Books	41	18.3	183	81.7	224
Social Media	22	9.9	201	90.1	223
Other	3	20.0	12	80.0	15

Note. *N* = total respondents who participated in the study. *n* = total participants who answered the question. *f* = number of participants who reported a usable answer.

Based on the Bonferroni-corrected test value (α = .49), an independent samples *t*-test determined no significant difference between direct mailings (*M*= 3.99, *SD*= 1.16) and all other preferred communication channels (*M*= 3.86, *SD*= 1.07), *t*(221) = .431, *p* = .682). Furthermore, the most preferred method of receiving water-related information by participants (*n* =205), although it was considered only slightly preferred, was direct mailings (*M* = 3.99, *SD* = 1.16). Additionally, participants reported no preference regarding websites (*M* = 3.20, *SD* = 1.43) and email (*M* = 3.10, *SD* = 1.55). Participants also reported to not prefer to receive information through social media communication channels (*M* = 1.29, *SD* = 1.13; See Table 3).

Table 3

Participants' Preferred Communication Channels to Receive Water-related Information (N= 275)

Communication Channel	*M*	*SD*	*n*
Direct mailings	3.99	1.16	205
Websites	3.20	1.43	203
Email	3.10	1.55	203
Television	2.77	1.35	209
Magazines	2.74	1.30	196
Books	2.49	1.25	192
Radio	2.36	1.23	191
Newspaper	2.80	1.35	103
Social Media	1.92	1.13	193
Other	2.55	1.37	11

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; 4.50 ≤ = most preferred

Based on the Bonferroni-corrected test value (α = .49), a one sample *t*-test determined a significant difference between participants' reported frequency to receive

direct mailings (*M*= 3.35, *SD*= 1.37) and all other communication channels, *t*(227) = 36.85, *p* = .000). Participants reported how frequently they preferred to receive water-related information (see Table 4). Participants reported websites (*n* = 84) were their most preferred communication channel for monthly delivery and reported direct mailings (*n* = 69) as their most preferred communication channel for quarterly delivery. Additionally, participants preferred to never receive water-related information on social media (*n* = 153).

Table 4

Participants' Frequency Preference for Frequency to Receive Water-related Information (n =275)

Communication Channel	*Monthly*	*Quarterly*	*Twice annually*	*Annually*	*Never*
Websites	84	20	22	30	59
Direct mailings	56	69	33	39	31
Email	52	42	20	17	92
Television	51	26	21	28	93
Newspaper	48	40	14	26	86
Magazines	35	29	25	30	93
Radio	34	21	10	20	123
Social Media	22	7	11	12	153
Books	11	13	14	35	133
Other	1	0	2	2	10

An independent *t*-test was calculated to compare communication preferences between male (*n* = 156) and female (*n* = 64) participants. Based on the Bonferroni-corrected test value (α = .49), there were no significant differences between male (*M*= 2.92, *SD*= .79) and female (*M*= 2.98, *SD*= 1.09) participants' preferred communication channels (*t*(91.82) = -.391, *p* = .697). Males (*M* = 3.87, *SD* = 1.13) and females (*M* =

4.27, *SD* = 1.19) slightly preferred to receive water-related information via direct mailings (see Table 5). Social media were reported as least preferred among males (*M* = 1.87, *SD* = 1.07) and slightly not preferred among females (*M* = 2.04, *SD* = 1.28).

Table 5

Participants' Landowners' Preferred Communication Channels based on Gender (N= 275)

	Male			*Female*		
Communication Channel	*M*	*SD*	*n*	*M*	*SD*	*n*
Direct mailings	3.87	1.13	143	4.27	1.19	60
Websites	3.28	1.39	141	3.00	1.54	61
Email	3.17	1.50	141	2.92	1.66	61
Magazines	2.87	1.22	140	2.44	1.45	55
Newspaper	2.82	1.27	143	2.76	1.55	59
Television	2.68	1.28	146	3.00	1.50	58
Books	2.53	1.20	137	2.41	1.38	54
Radio	2.41	1.20	134	2.25	1.31	56
Other	2.50	1.23	6	2.60	1.67	5
Social Media	1.87	1.07	135	2.04	1.28	57

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; 4.50 ≤ = most preferred

Participants of ethnicities other than Caucasian (e.g., American Indian, Asian, Black or African American, Native Hawaiian or Pacific Islander, Spanish, Hispanic, Latino), were collapsed into a single group for comparison due to sample size. To compare communication preferences between Caucasian (*n* = 195) and other ethnicities (*n* = 19), an independent *t*-test was used. Based on the Bonferroni-corrected test value (α = .49), there were no significant differences between Caucasian and other ethnicities, ($t(212) = 1.978$, $p = .049$). Among participants who reported to slightly prefer direct mailings, other ethnicities (e.g., American Indian, Asian, Black or African American,

Native Hawaiian or Pacific Islander, Spanish, Hispanic, Latino) reported a higher preference for direct mailings (M = 4.40, SD = .83), than Caucasian participants (M = 3.96, SD = 1.17). Additionally, other ethnicities (M = 2.13, SD = 1.46) reported a higher preference for social media than Caucasian participants (M = 1.88, SD = 1.09; see Table 6).

Table 6

Participants' Preferred Communication Channels based on Ethnicity (N= 275)

	Caucasian			*All Other Ethnicities*		
Communication Channel	*M*	*SD*	*n*	*M*	*SD*	*n*
Direct mailings	3.96	1.17	183	4.40	.83	15
Email	3.07	1.52	180	3.18	1.81	17
Newspaper	2.76	1.33	180	3.29	1.49	17
Magazines	2.75	1.03	176	2.71	1.33	14
Television	2.65	1.31	180	3.89	1.08	18
Other	2.50	1.43	10	3.00	0.00	1
Books	2.42	1.20	172	2.86	1.46	14
Radio	2.30	1.18	171	2.93	1.39	14
Websites	3.21	1.40	181	2.94	1.81	16
Social Media	1.88	1.09	172	2.13	1.46	15

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; 4.50 ≤ = most preferred

A one-way analysis of variance (ANOVA) was calculated to compare communication preferences among participants' reported age categories: ≤54 (n = 48), 55 to 64 (n = 70), 65 to 74 (n = 66), and ≥75 (n = 34). Based on the results of the one-way ANOVA, the effect of participants' reported age category was not significant in regard to their communication preference (F(3,214) = 1.172 , p = .321, 1- β = .313). Participants of all ages slightly preferred to receive water-related information via direct

mailings: <54 (*M* = 4.04, *SD* = .96); 55 to 64 (*M* = 4.08, *SD* = 1.19); 65 to 74 (*M* = 3.97, *SD* = 1.25); and >75 (*M* = 3.77, *SD* = 1.26). Additionally, participants of all ages slightly did not prefer to receive water-related information via social media: <54 (*M* = 2.40, *SD* = 1.37); 55 to 64 (*M* = 1.82, *SD* = 1.03); 65 to 74 (*M* = 1.65, *SD* = .95); and >75 (*M* = 1.86, *SD* = 1.03; see Table 7).

Table 7

Participants' Preferred Communication Channels based on Age (N= 275)

	< 54			*55 —64*			*65 – 74*			*>75*		
Communication Channel	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Direct mailings	4.04	.96	47	4.08	1.19	65	3.97	1.25	59	3.77	1.26	31
Websites	3.63	1.25	46	3.45	1.40	64	2.87	1.49	60	2.71	1.42	31
Email	3.43	1.53	46	3.14	1.55	65	2.92	1.56	59	2.87	1.54	31
Other	3.00	.00	1	2.00	1.12	4	2.75	2.06	4	3.00	.00	2
Television	2.93	1.34	46	2.54	1.35	67	2.80	1.39	59	2.87	1.25	30
Radio	2.91	1.26	45	2.22	1.20	60	2.14	1.18	56	2.21	1.13	28
Newspaper	2.89	1.32	47	2.54	1.35	65	2.74	1.31	57	3.28	1.37	32
Magazines	2.87	1.29	46	2.66	1.30	62	2.75	1.32	55	2.71	1.32	31
Books	2.51	.91	43	2.57	1.35	61	2.36	1.30	56	2.60	1.40	30
Social Media	2.40	1.37	45	1.82	1.03	60	1.65	.95	57	1.86	1.03	29

Note. ≤ 1.50 = least preferred; 1.51 – 2.49 = slightly not preferred; 2.50 – 3.49 = no preference; 3.50 – 4.49 = slightly preferred; 4.50 ≤ = most preferred

A *z*-test was calculated to compare means of participants' reported sources of water-related information they currently receive water-related information from. Based on the Bonferroni-corrected test value ($\alpha = .49$), there was significant difference between industry groups and environmental groups, agricultural service providers, trade shows/fairs, and county health department, $z = 1.327$, $p = .18352$. More than 80% of participants had never received water-related information from a county health department ($f = 206$). Only 36.1% of participants reported receiving water-related information from industry groups ($f = 84$), and 35% reported receiving water-related information from government agencies ($f = 84$; see Table 8).

Table 8

Participants' Current Sources for Receiving Water-related Information (n=275)

	Yes		*No*		
Information Source	*f*	*%*	*f*	*%*	*n*
Industry groups	84	36.1	149	63.9	233
Government agencies	84	35.6	152	64.4	236
Friends and neighbors	81	34.6	153	65.4	234
Texas A&M AgriLife Extension	80	34.3	153	65.7	233
Texas Parks and Wildlife	66	29.2	160	70.8	226
Environmental groups	41	17.8	189	82.2	230
Agricultural service providers	38	16.4	194	83.6	232
Trade shows/fairs	27	11.9	199	88.1	226
County health department	25	10.8	206	89.2	231
Other	5	22.7	17	77.3	22

Note. N = total respondents who participated in the study. *n* = total participants who answered the question. *f* = number of participants who reported a usable answer.

Overall, participants reported Texas A&M AgriLife Extension (*M* = 3.16, *SD* = .82), Texas Parks and Wildlife (*M* = 2.88, *SD* = .83), industry groups (*M* = 2.73, *SD* = .80), and government agencies (*M* = 2.64, *SD* = .86) as trustworthy sources of information. Participants also reported environmental groups as somewhat trustworthy (*M* = 1.99, *SD* = .90; see Table 9).

Table 9

Participants' Perceived Level of Source Trustworthiness for Receiving Water-related Information (N= 275)

Information Source	*M*	*SD*	*n*
Texas A&M AgriLife Extension	3.16	.82	169
Texas Parks and Wildlife	2.88	.83	156
Industry groups	2.73	.80	166
Government agencies	2.64	.86	177
County health department	2.47	.83	145
Friends and neighbors	2.44	.80	161
Agricultural service providers	2.28	.79	151
Trade shows/fairs	2.16	.77	141
Environmental groups	1.99	.90	147
Other	2.29	1.38	14

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; 3.50 ≤ = very trustworthy

I used a one-way analysis of variance (ANOVA) to compare source trustworthiness among participants' reported age categories: ≤54 (*n*=50), 55 to 64 (*n*=75), 65 to 74 (*n*=68), and ≥75 (*n*=40). Based on the results of the one-way ANOVA, the effect of participants' reported age category was not significant in relation to their source trustworthiness ($F(3,229) = .679$, $p = .130$, $1- \beta = .488$). There were no differences between participants' reported age and the sources they reported as

trustworthy (see Table 10). Participants of all ages perceived Texas A&M AgriLife Extension as trustworthy: <54 (*M* = 3.30, *SD* = .72); 55 to 64 (*M* = 3.20, *SD* = .78); 65 to 74 (*M* = 3.10, *SD* = .89); and >75 (*M* = 3.04, *SD* = .93). Additionally, participants of all ages perceived environmental groups as somewhat trustworthy: <54 (*M* = 2.15, *SD* = 1.02); 55 to 64 (*M* = 1.96, *SD* = .79); 65 to 74 (*M* = 1.88, *SD* = .87); and >75 (*M* = 2.11, *SD* = 1.02; see Table 10).

Table 10

Participants' Age in Relation to Source Trustworthiness (N= 275)

	< 54			*55 —64*			*65 – 74*			*>75*		
Communication Channel	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Texas A&M AgriLife Extension	3.30	.72	40	3.20	.78	50	3.10	.89	52	3.04	.93	23
Texas Parks and Wildlife	2.94	.79	36	2.79	.80	48	2.98	.88	51	2.75	.91	20
Government agencies	2.88	.84	41	2.67	.85	54	2.41	.83	56	2.71	.91	24
Industry groups	2.72	.79	39	2.81	.72	52	2.67	.90	52	2.70	.80	20
Friends and neighbors	2.58	.73	36	2.37	.74	52	2.53	.92	51	2.21	.71	19
County health department	2.44	.72	32	2.48	.78	46	2.37	.89	51	2.80	.94	15
Other	2.33	1.53	3	1.00	.00	1	2.17	1.47	6	3.33	1.12	3
Agricultural service providers	2.30	.74	37	2.30	.81	47	2.27	.79	49	2.29	.92	17
Trade shows/fairs	2.27	.84	33	2.17	.68	46	2.07	.77	46	2.13	.92	15
Environmental groups	2.15	1.02	34	1.96	.79	46	1.88	.87	48	2.11	1.02	18

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; 3.50 ≤ = very trustworthy

An independent *t*-test was used to compare source trustworthiness between male (n = 166) and female (n = 71) participants. Based on the Bonferroni-corrected test value (α = .49), there were no significant differences between male and female participants' preferred communication channels ($t(235) = .786$, $p = .411$). Males (M =3.17, SD = .80) and females (M =3.16, SD = .88) reported Texas A&M AgriLife Extension as a trustworthy source of water-related information. Although males (M = 1.94, SD = .88) and females (M = 2.11, SD = .92) reported environmental groups as somewhat trustworthy sources, females reported them as slightly more trustworthy (see Table 11).

Table 11

Participants' Gender in Relation to their Perceived Source Trustworthiness (N=275)

	Males			*Females*		
Information Source	*M*	*SD*	*n*	*M*	*SD*	*n*
Texas A&M AgriLife Extension	3.17	.80	115	3.16	.88	51
Texas Parks and Wildlife	2.85	.83	107	2.96	.84	49
Industry groups	2.77	.74	114	2.65	.91	51
Government agencies	2.63	.85	123	2.66	.88	53
Friends and neighbors	2.47	.78	109	2.40	.86	50
County health department	2.41	.80	97	2.58	.87	48
Agricultural service providers	2.25	.67	102	2.35	.95	49
Trade shows/fairs	2.12	.71	95	2.24	.87	46
Environmental groups	1.94	.88	101	2.11	.92	46
Other	1.63	1.06	8	3.17	1.33	6

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; 3.50 ≤ = very trustworthy.

An independent *t*-test was used to compare source trustworthiness between Caucasian (n=207) and other ethnicities (n=20). Based on the Bonferroni-corrected test value (α = .49), there were no significant differences between Caucasian and other

ethnicities ($t(225) = -1.178$, $p = .162$). When compared to Caucasian participants ($M = 3.16$, $SD = .80$), participants from other ethnicities (i.e., American Indian, Asian, Black or African American, Native Hawaiian or Pacific Islander, Spanish, Hispanic, Latino) reported having more trust in the Texas A&M AgriLife Extension ($M = 3.20$, $SD = .92$). Additionally, other ethnicities ($M = 2.60$, $SD = .97$) as well as Caucasian participants ($M = 1.95$, $SD = .87$) reported environmental groups were somewhat trustworthy (see Table 12).

Table 12

Participants' Ethnicity in Relation to Source Trustworthiness (N=275)

	Caucasian/White			*All Other Ethnicities*		
Information Source	*M*	*SD*	*n*	*M*	*SD*	*n*
Texas A&M AgriLife Extension	3.16	.80	152	3.20	.92	10
Texas Parks and Wildlife	2.89	.83	142	3.00	.82	10
Industry groups	2.73	.79	150	2.80	.92	10
Government agencies	2.61	.85	159	3.00	.78	11
County health department	2.45	.81	130	2.80	.92	10
Friends and neighbors	2.44	.78	144	2.55	.93	11
Other	2.38	1.39	13	-	-	0
Agricultural service providers	2.26	.77	136	2.64	.92	11
Trade shows/fairs	2.11	.74	127	2.67	.87	9
Environmental groups	1.95	.87	131	2.60	.97	10

Note. ≤ 1.50 = not trustworthy; 1.51 – 2.49 = somewhat trustworthy; 2.50 – 3.49 = trustworthy; 3.50 ≤ = very trustworthy

Types of Water-related Information Landowners Prefer to Receive

Participants reported they were interested in receiving all types of water-related information but were most interested in receiving information about current water quality levels (*M* = 3.07, *SD* = .84) and specific conservation practices that improve water quality (*M* = 2.97, *SD* = .87). Participants who noted they were interested in other types of information were concerned with information about wild pig management, impact of prescribed burning on water quality, and well water testing (see Table 13).

Table 13

Participants' Preference for Types of Water-related Information (N = 275)

Type of Information	*M*	*SD*	*n*
Current water quality levels	3.07	.84	232
Specific conservation practices that improve water quality	2.97	.87	232
Policies related to water	2.93	.89	230
How landowners can improve their operation by adopting water conservation practices	2.93	.90	232
How practices will improve/profit your land	2.93	.94	230
Updates on conservation practice effectiveness	2.84	.90	228
Pesticide/fertilizer application management	2.80	.94	226
How to install/maintain conservation practices	2.80	.96	230
How agricultural production impacts your water quality	2.75	.84	232
How water quality impacts your operation	2.72	.93	232
Fertility application methods that are conscious of water	2.69	.99	222
Other	2.40	1.51	10

Note. ≤ 1.50 = not interested; 1.51 – 2.49 = somewhat interested; 2.50 – 3.49 = interested; 3.50 ≤ = highly interested

Participants also reported the need for information related to current water quality levels (*M* = 2.70, *SD* = .98) and how practices will improve/profit their land (*M* = 2.67, *SD* = .98). Other types of information participants reported as a need included

managing invasive non-native weeds that wash into property and water regulations and laws (see Table 14).

Table 14

Participants' Need for Water-related Information (N= 275)

Type of information	*M*	*SD*	*n*
Current water quality levels	2.70	.98	228
How practices will improve/profit your land	2.67	.98	227
Specific conservation practices that improve water quality	2.66	.98	224
Policies related to water	2.66	.99	224
How landowners can improve their operation by adopting water conservation practices	2.64	.10	226
Updates on conservation practice effectiveness	2.59	.96	227
How to install/maintain conservation practices	2.58	.10	227
Pesticide/fertilizer application management	2.56	.98	222
Fertility application methods that are conscious of water	2.43	.99	210
How agricultural production impacts your water quality	2.42	.97	226
How water quality impacts your operation	2.27	.98	223
Other	2.81	1.33	16

Note. ≤ 1.50 = not needed; 1.51 – 2.49 = somewhat needed; 2.50 – 3.49 = needed; 3.5 ≤ = very needed

A statistical significance was found between participants who reported receiving information from a source and found the source trustworthy (see Table 15). Participants who received information from Texas A&M AgriLife Extension viewed more the organization to be more trustworthy (M = 3.37, SD = .63) than those who do not receive information from Texas A&M AgriLife Extension (M = 2.99, SD = .92). This difference was significant $t(165) = 3.09$, $p = .002$, and it represented a medium-sized effect (d = .48).

Table 15

Participants' Current Source of Information in Relation to Source Trustworthiness

Source of Information	*Yes Receive information*		*No Receive information*					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Texas A&M AgriLife Extension	3.37	0.63	2.99	0.92	165.00	3.09	.002	.48
Texas Parks and Wildlife	3.02	0.72	2.81	0.90	146.12	1.60	.111	.26
Industry groups	2.95	0.68	2.51	0.85	154.64	3.67	.000	.59
Government agency	2.90	0.77	2.43	0.88	174.58	3.86	.000	.58
County health departments	2.82	0.80	2.41	0.86	140.00	2.15	.033	.36
Agricultural service providers	2.70	0.78	2.13	0.73	147.00	4.05	.128	.67
Friends and neighbors	2.66	0.71	2.23	0.80	157.00	3.61	.000	.58
Other	2.50	1.73	2.14	1.35	9.00	0.38	.710	.25
Trade shows/fairs	2.42	0.72	2.08	0.76	135.00	2.00	.048	.34
Environmental groups	2.39	1.00	1.87	0.82	55.68	2.91	.005	.78

There was statistical significant differences between participants who reported to currently receive information through an identified communication channel and also prefer to receive information through that channel (see Table 16). Participants who currently receive information from direct mailings (e.g. newsletters, brochures, fliers) also slightly more preferred (M = 4.24, SD = 0.94) to receive information from direct mailings than those who did not receive information through direct mailings (M = 3.67, SD = 1.32). This difference was significant $t(168.51) = 3.43$, $p = .001$, and it represented a medium-sized effect ($d = .53$).

Table 16

Participants' Current Use of Communication Channels in Relation to their Preferred Use of Communication Channels

Source of Information	*Yes Receive information*		*No Receive information*					
	M	*SD*	*M*	*SD*	*df*	*t*	*p*	*Cohen's d*
Direct mailings	4.24	.94	3.67	1.32	168.51	3.43	.001	0.53
Other	4.00	1.00	2.00	1.10	7.00	2.35	.033	1.78
Email	3.96	1.17	2.85	1.55	119.04	5.34	.000	0.98
Books	3.72	1.00	2.18	1.10	182.00	7.65	.000	1.13
Newspaper	3.62	1.03	2.20	1.24	192.63	8.74	.000	1.26
Social Media	3.53	0.87	1.76	1.04	183.00	6.77	.000	1.00
Magazines	3.48	1.09	2.14	1.15	188.00	8.19	.000	1.19
Television	3.47	1.14	2.30	1.27	173.90	6.74	.000	1.02
Radio	3.30	0.97	2.10	1.18	74.59	6.58	.000	1.52
Websites	1.09	0.96	2.57	1.39	190.89	9.01	.000	1.30

Conclusions

The results of this study provided guidance to successfully deliver water-related information to landowners to encourage adoption of BMPs, and ultimately reduce pollutants entering Texas waterways. In this study, participants most preferred to receive water-related information quarterly through direct mailings. This supported the findings from Rosenberg and Margerum, (2008) and Howell and Habron (2004) who suggested newsletters were a preferred communication channel for information diffusion. Specifically, participants in the age range of 55 to 64 reported a higher preference for direct mailings than all other age groups.

Participants reported they had not received water-related information from industry groups and government agencies. Furthermore, results indicated 34.2% of participants received water-related information from magazines, and 33.4% received information from newspapers, which supported Boellstorff et al. (2010). Additionally, participants reported a preference to receive water-related information through websites and via email monthly. Although email was not a strong preference among participants, male participants preferred email over female participants, which supported previous research by Truffle Media Networks (2012). However, Caucasian participants' least preferred social media, which contradicts Cline's (2011) findings that 93% of Caucasian individuals, who live or work on a farm, used social media to access agricultural-related information and engage in conversation. The lack of preference for email and social media does not support the fact that agricultural organizations use social media in today's society to educate and inform agricultural audiences (White et al., 2014; Moore et al., 2015). Therefore, further research should be conducted to explore the use of social media and Internet technology in this watershed. Not only is social media a beneficial way to inform the public about agricultural information but it is also more cost effective than direct mailings.

Participants were interested in receiving water-related information (e.g., water quality levels, specific conservation practices that improve water quality) and environmental specific information regarding the quality of water, which contradicted what Jackson-Smith and McEvoy (2011) suggested as being unsuccessful in changing behavior. In addition to types of information, participants reported Texas A&M AgriLife

Extension, Texas Parks and Wildlife, industry groups, and government agencies to be somewhat trustworthy information sources, which supported Rosenberg and Margerum (2008) suggestion that Extension agents were a trusted source of information. Perhaps, participants share the same views as these sources of information, as suggested by Cline (2011), and seek to find like-minded sources. Additionally, these sources of information may be perceived as transparent in and accountable for the information they provide to the public, which Giupponi and Sgobbi (2008) suggested as factors in trustworthiness.

Of the participants who reported Texas A&M AgriLife Extension as a somewhat trustworthy source, participants 54 and younger and participants of ethnicities other than Caucasian found Texas A&M AgriLife Extension to be more trustworthy than other age groups and Caucasians. Furthermore, participants in the age range of 65 to 74 reported the lowest level of trust for government agencies, and male participants reported the lowest level of trust for environmental groups. The sources participants determined as trustworthy could provide assistance in the assimilation of information (Stone et al., 1999). Information that is delivered to landowners by the identified trusted sources will have a higher likelihood of adoption. Although Rosenberg and Margerum (2008) suggested friends, family, neighbors were a trusted source of information, participants in this study indicated friends and neighbors were only somewhat trustworthy.

Recommendations

A quantitative follow-up questionnaire should be delivered to the sample once the WBP has been developed. The follow-up questionnaire would document the effectiveness of the delivery of water-related information and could further add to

understanding of the elements of the information diffusion theory (Stone et al., 1999). Documentation of outreach and education outcomes throughout the watershed would also allow adjustments to the implementation stage of the WBP.

Results of this study should be communicated to the identified sources used in the study. Partnerships can be created among the sources who were reported as more trustworthy and assist in informing landowners in the counties about water-related information. It would be beneficial to use the communication channels that participants reported as preferred to ensure information is delivered in methods that are suitable to participants. Further investigation is needed regarding the trustworthiness of sources. Although county health departments were not reported as a trustworthy source compared to other identified sources, they can be an informational source related to health associated with drinking surface water in regional rural areas.

Further research is needed in regard to the use of social media communication channels to deliver water-related information. The dramatic changes in information access associated with smart phones and the Internet offer cost effective means to reach individuals. These tools (e.g., smart phones, websites) are not only a way to communicate short, specific, and assimilated messages to the public but also provide quick and effective ways to deliver water-related information and allow two-way conversations between the audience and the source. While this study did not support use of social media, further research is warranted.

Friends and neighbors was a source of information that was not considered trustworthy in this study, but was reported as such in other research (Rosenberg &

Margerum, 2008; Morton, Bitto, & Brant, 2001). Further, these sources, connected to interpersonal communication, have been documented as assisting in the adoption of innovations (Rogers, 2010). Interviews with participants of this study would assist in understanding why friends and neighbors were not considered a trustworthy source. Community and relationships with others can assist in participation in WBPs as well as the adoption of BMPs. Understanding these relationships is critical.

Additional research related to participants' motivations and barriers to adopting BMPs is needed in order to further tailor messages, outreach, and education to encourage adoption of BMPs related to the regional WBP. Documentation of landowners' participation in creating WBPs will allow understanding of why or why not landowners choose to participate in the planning process of creating a watershed plan.

Implications

Results of this study have been provided to program administrators who can utilize findings to more effectively deliver water-related information to landowners across the Little River watershed. The implication is that landowners will be better informed about water quality and information regarding BMPs for their land, which will ultimately impact the adoption of BMPs. Further, others interested in diffusing water-related information may find study findings (i.e., sources of water-related information, source trustworthiness, etc.) useful in their own contexts.

CHAPTER III

LANDOWNERS' MOTIVATIONS FOR AND BARRIERS TO ADOPTING BEST MANAGEMENT PRACTICES: ECONOMIC, INTRINSIC, AND KNOWLEDGE FACTORS

Introduction

The amount of quality water available for human use in the United States is diminishing. A decline in the amount of groundwater in combination with an increase in population growth results in a demand for clean available surface water (Wurbs, 2014). For instance, 117 million Americans obtain their drinking water from streams protected by the Environmental Protection Agency's Clean Water Act (EPA, 2016d). However, only 2.5% of the earth's water is fresh and usable for humans and animals (National Geographic, n.d.). Consequently, it is important to protect the available water for the growing population.

How do waterways in the United States become unusable? Pollution typically caused by human activities can reduce the quality of fresh water that is available. Human activities, such as agricultural production, soil structure disturbance, animal feedlots, agriculture, and urban runoff, are leading nonpoint sources of pollution in U.S. rivers and streams (Centers for Disease Control and Prevention (CDC), 2010; EPA, 2016d; National Oceanic and Atmospheric Administration, 2015). To mitigate pollution entering waterways, landowners can adopt Best Management Practices (BMPs), which help reduce or diffuse pollution created on agricultural lands, ultimately improving water quality (Greiner, Patterson, & Miller, 2009). Such practices include area livestock

grazing plans and critical area tree plantings (United States Department of Agriculture, n.d.a). Many pollutants (e.g., chemicals, bacteria) are naturally filtered through existing forests, grasslands, and other BMPs (Iowa Department of Natural Resources, n.d.). Unfortunately, the lack of adoption of BMPs allows pollutants to freely enter the waters. Thus, although these practices help the environment, many landowners face barriers preventing adoption.

Sparking landowners' motivations, can assist them in persisting through perceived barriers towards adoption. Motivation can be defined as psychological energizing factors that lead to human physical behavior (Kelinginna & Kleinginna, 1981). Such factors must be appealing to and spark an emotional feeling in an individual to result in a change in behavior (Heath & Health 2010). Motivation entices behavior; whereas, barriers prevent change in human behavior. Factors resulting in a change in behavior or preventing a change in behavior can include economic, intrinsic, and knowledge elements, as suggested by previous research (Rodriguez, Molnar, Fazio, Sydnor, & Lowe, 2009; De Young, 1968; Molnar et al., 2001). No matter what factors motivate or prevent a change in behavior, relative advantage influences landowners (Greiner et al., 2009).

Relative advantage is considered "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2012, p. 229). This idea is a factor in positive or negative adoption across all reasons for adoption. For example, the less landowners are able to connect with an idea, the less likely they are to adopt a practice (Reimer, Weinkauf, & Prokopy, 2012). Connection can be made by the landowner, when

they find the new practice to be convenient and relatable to their current land management situation. Vining and Ebero (1990) found individuals who did not recycle were more concerned with the convenience of recycling than with the rewards associated with recycling. In short, no matter the motivating factors, practices should be convenient and provide rewards to an individuals' life and current behavior. Motivators and barriers can be attributed to economic, intrinsic, and knowledge factors.

Economic

"Initial cost" of implementing a practice as well as the cost of "changing from one management style to another" can prevent landowners from adopting BMPs (Rodriguez et al., 2009, p. 65; Rogers, 2012). Perry-Hill and Prokopy (2014) found that even small agricultural and rural residential landowners perceived cost as a barrier to adopting conservation practices. Many organizations use external rewards and economic incentives, such as the USDA's Environmental Quality Incentives Program (EQIP), to entice or reinforce individuals' behaviors (Rogers, 2012). In contrast, such programs do not offer enough money to cover the cost of implementing BMPs (Rodriguez et al., 2009).

Short-term economic incentives do not create sustainable long-term adoption of conservation practices. Berthold (2014) reported that landowners found initial cost of implementation of a BMP and low levels of cost-share money were barriers to BMP adoption. Not only was limited initial funding to assist landowners in reducing the upfront costs an economic barrier, but adopting long-term BMPs can also create financial uncertainty. Furthermore, Rodriguez et al. (2009) stated that "potential loss in

income does not justify adopting more sustainable practice[s]" (p. 66). Thus, landowners are not willing to adopt conservation practices due to the potential loss of income. However, De Young (1993) admitted that immediate short-term influences, such as economic incentives, to change behavior was not effective in long-term use of conservation practices. Risking a loss of income is unjustifiable, considering that some landowners contemplate their financial status and their personal concern for the land.

Landowners in an Illinois watershed had competing interests between their environmental stewardship and income-based land ownership (Thompson, Reimer, & Prokopy, 2015). In other words, landowners were concerned with the financial gains and losses associated with implementing BMPs, despite their belief that the practice was good for the environment and should be implemented. Similarly, landowners who saw their farm operation as a business and were mostly concerned with the profitability of their land management were also less likely to adopt conservation practices (Reimer, Thompson, & Prokopy, 2012). In contrast to this belief, some landowners in Washington were willing to sacrifice profit to implement practices that reflected good land stewardship (Chouinard, Paterson, Wandschneider, & Ohler, 2008).

Some landowners are more cautious about their financial certainty, whereas other landowners are willing to sacrifice financial gain to implement agriculture practices that have a positive impact on the environment. Turaga, Howarth, and Borsuk (2010) questioned good stewardship practices, and insist that individuals do not participate in pro-environmental behaviors strictly for self-interest, thus, suggesting individuals search for external rewards. Economic incentives, paired with personal beliefs and attitudes

toward conservation practices, were together motivational factors in adoption (McGuire, Morton, Cast, 2013).

Intrinsic

Sheeder and Lynne (2011) documented economic incentives as bribes to encourage landowners to adopt practices, but these incentives were not the only motivating factor. Rather than participating in a behavior because of external pressures or rewards, internal motivations encourage individuals to pursue a behavior for personal satisfaction (Ryan & Deci, 2000). De Young (1986) supported intrinsic motivations, suggesting that individuals are driven by their personal satisfaction of performing conservation activities.

Intrinsic motivators are not new concepts. Christensen and Norris (1983) believed farmers are not always driven by the profit maximization (e.g., economics) of new BMPs but that values, beliefs, social pressures, and traditions have a stronger impact on their attitudes and adoptions. Internal emotional factors, such as values and beliefs, motivate individuals to make a change in behavior (Heath & Heath, 2010). Rosenberg and Margerum (2008) found that landowners who consider themselves to have an internal connection to and feel morally driven to take care of their land were more likely to adopt conservation practices. Thus, intrinsic motivations could be a strong influence for encouraging long-term adoption of conservation practices (Ryan, Erickson, & De Young, 2002).

Although intrinsic motivation does not come from outside sources (Ryan & Deci, 2000), external rewards, such as societal pressures, can spark an individual's intrinsic

motivation, and create awareness of circumstances. Until landowners "believe there is a problem and that they should do something different, they will not be motivated to change their behaviors" (Morton, 2011, p. 218). When individuals are aware of the positive or negative consequences of their behavior, they are morally driven to continue or change their behavior to reach a state of societal acceptance and personal satisfaction (Schwartz, 1970; Turaga et al., 2010). When individuals assess their own behavior, they seek to avoid dissonance or an uncomfortable state of mind due to an attitude, feeling, or behavior (Festinger, 1957; Rogers, 2010). In other words, landowners who evaluate their behavior as negative and believe the behavior is adding to the source of the problem, strive for internal equilibrium and perform behaviors that apply accordingly. Behaviors that create possible dissonance are motivated by individuals' emotional connection to the problem or solution, typically through the help of other individuals in the society (Kotter & Cohen, 2002). Assistance from others can be found through interpersonal communication, such as face-to-face conversation (Rogers, 2010).

Connected to interpersonal communication, concern for neighbors' land and their community is another social factor to explore when understanding landowners' "sense of obligation to their community" which is considered a convincing factor in encouraging adoption of conservation practices (Ryan et al., 2002, p. 33). Landowners who consider themselves to be positive contributors to their community and have strong attachment to their land, regard their private land as a place to be good stewards of the land (Sheeder & Lynne, 2011). Some landowners are motivated by this idea of stewardship as their duty to "look after the environment" (Greiner et al., 2009, p. 260).

Barriers to adopting a conservation practice, due to intrinsic motivations, can be difficult to pinpoint. To reiterate, intrinsic motivation that drives behavior stems from an individual accepting the new behavior as a personal benefit or as a reward (Ryan & Deci, 2000). Thus, if a landowner finds a practice to not be a reward or benefit to them, they will most likely choose not to adopt the practice, because they are not intrinsically motivated to do so. Other factors motivating or preventing landowners from adopting BMPs, can be simpler.

Knowledge

Knowledge is considered an important factor in the process of adoption (Rogers, 2010); thus, a lack of access to information or knowledge of a topic results in becoming a barrier. Rodriguez et al. (2009) found that "lack of knowledge or education 'concerning sustainable agricultural practices' was frequently expressed as a barrier" (p. 66). Research by Berthold (2014) supported this, determining that lack of information and awareness was considered the second highest barrier to adopting BMPs. In addition to being aware of BMPs, how familiar landowners are with conservation practices and general "how to" information about the practice can potentially be a barrier also (Molnar et al., 2001). Consequently, the knowledge of potential risks associated and complexity of some BMPs, are limiting factors in the adoption of the practices as well (Reimer et al., 2012). This ambiguity or uncertainty of BMPs can elicit doubt among individuals (Hardin, 2013). For example, contract terms of governmental economic incentive programs (e.g., years of implementing, design, etc.) regulate how the landowners manage the BMPs. Uncertainty prevails when knowledge is withheld or unavailable to

landowners. Thus, knowledge can be considered a factor in adopting BMPs. This review of literature has explored three important factors that influence individuals in the adoption of an innovation. However, structured theory from Rogers (2010) regarding the innovation-decision process can assist in understanding how to effectively diffuse information regarding innovations to landowners.

Theoretical Framework

Rogers' (2010) diffusion of innovations theory can be applied to understand how innovations such as BMPs are disseminated to landowners. Diffusion theory is defined as a process in "which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2010, p. 35). In other words, this theory should be viewed as how BMPs disseminate through communication channels to landowners over time, with adoption of the practices as the end result. Human behavior is not the element of focus in this theory, but instead how the innovation is promoted and diffused to change human behavior.

Conversely, how humans change their behavior can be evaluated through the innovation-decision process (Rogers, 2010). As an innovation disseminates through a social system over time, individuals go through the innovation-decision process. This theory focuses on factors that influence individuals to adopt or disregard an innovation. The innovation-decision process includes five stages that impact an individual's likelihood to adopt a new idea: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2010). Beginning with the knowledge stage, an individual is exposed to the innovation and begins to gain information regarding the innovation.

Rogers (2010) states that individuals who seek out information about the innovation have pre-existing attitudes, interests, and needs in accordance to the innovation. This is called selective exposure— "the tendency to attend to communication messages that are consistent with the individual's existing attitudes and beliefs" (Rogers, 2010, p. 171). Selective perception is apparent when individuals do not feel there is need for the innovation, thus do not seek information about the innovation and general exposure has little effect because the individual's needs do not align with the innovation.

After an individual determines the innovation to be of interest or need, they move to the persuasion stage. In this stage, an individual creates an attitude towards the innovation (Rogers, 2010). Feelings towards the innovation are apparent during this time and a favorable or unfavorable outcome will be exposed. Also during this stage, individuals may see the innovation as preventative to a future event. With preventative innovations, such as BMPs, individuals adopt an innovation "in order to avoid the possible occurrence of some unwanted event in the future" (Rogers, 2010, p. 176). Associated with water quality, landowners possibly adopt BMPs to avoid polluting the waterways in their area in the future, deeming it a preventative innovation.

If a positive attitude is created during the persuasion stage, an individual progresses to the decision stage. Individuals or a group of individuals participate in activities that lead to their decision to either adopt or reject the innovation because the innovation's results do not meet the individual's needs or expectations (Rogers, 2010). There are two ways to reject an innovation, in which Rogers (2010) described as active and passive rejection. Active rejection occurs when an individual considers adopting the

innovation by trying it out, but determining not to fully adopt. Whereas passive rejection is when an individual never considers the use of the innovation, thus does not attempt to try the innovation. An individual continues to the implementation stage if they decide not to reject the innovation, and has approved the use of the innovation through activities.

During the implementation stage, the individual continues to use the innovation from the trial period during the persuasion stage. Throughout this stage, the individual tests their certainty of the innovation and how the innovation will relate to their current situation. They begin to thoroughly evaluate the adoption of an innovation and the impact it will have on their operation. Rogers (2010) explained that more problems arise when adopting the innovation during this stage, for example, if there is more than one individual, or an organization, making the decision to adopt. Competing thoughts, beliefs, and perceptions held by each individual about the innovation, attribute to the adoption or rejection of the innovation during this stage. If the individual decides to continue with the innovation, they move to the confirmation stage.

During this final stage, reinforcement supporting the decision to adopt the practice is sought (Rogers, 2010). Meaning that individuals search for positive results and outcomes of the innovation confirming their adoption decision. Also during this stage, individuals attempt to reject dissonance, or shy away from an uncomfortable state of mind regarding the innovation. Thus, if an individual perceives the innovation to be unsuccessful, they will most likely reject the innovation, which is defined as

discontinuance. If the innovation provides the individual satisfaction and positive confirmation, they will continue using the innovation in the future.

For full adoption of the innovation, each stage must be met and accomplished before moving on to the next, although the individual can reject the innovation at any point in the process. Throughout the process, many factors are associated with diffusion that influence motivations and barriers, such as personality characteristics (Rogers, 2010). Personality variables generally associated with earlier adoption of an innovation include: having greater empathy or connectedness (Rogers, 2010; Sheeder & Lynne, 2011), and greater openness to new ideas, such as changing their current land management behaviors.

It is important to keep in mind the diffusion of the innovation. How the innovation is promoted and communicated throughout the social system should be taken into consideration when evaluating how an individual goes through the innovation-decision process. Depending on how the innovation is diffused (e.g., volunteer based approaches, incentive money, general knowledge of the innovation), an individual might not even take part in the innovation-decision process, or if they do they might easily reject the innovation.

To understand the factors that motivate and hold back behaviors related to adopting an innovation, specific populations should be assessed. Assessing specific populations within a target area of need can have a positive influence on adoption of innovations (Tucker & Napier, 2002). This understanding can help environmental

organizations develop effective education to increase the number of participants in adopting BMPs (Christensen & Norris, 1983).

Problem

Improving polluted watersheds in the United States requires private landowners' effort to make land management decisions to adopt and implement BMPs. To entice landowners to implement BMPs, environmental organizations offer financial funding for implementing such practices. For example, USDA's Natural Resources Conservation Service offered $150 million to landowners across the U.S. through the Conservation Stewardship Program (CSP), where an estimated 10 million acres were affected by the implementation of BMPs associated with the program (USDA, n.d.c). Currently, federal, state, and local agencies use volunteer-based approaches to encourage participation in programs like CSP. Such approaches are not effective, because landowners should be approached about potential natural resource concerns (Arbuckle, 2013). This seems contradictory considering programs such as CSP incorporate specific conservation practices based on the regional natural resource concerns voiced by private landowners and USDA conservationists during local work group meetings (United States Department of Agriculture, n.d.c). Volunteer-based programs strictly rely on landowners' personal motivations to participate in local work groups and stewardship programs. To encourage participation in programs, ultimately reducing pollutants entering waterways, an understanding of the motivations and barriers landowners face is needed.

Context for Texas Watershed Management

"Bacteria Is the No. 1 pollutant of water in Texas, causing many of the state's water bodies to be places on the Texas Water Quality Inventory and 303(d) List for failing to meet contact recreation use standards" (Foust, 2010). In recent years, tributaries of the Little River watershed in Texas were impaired for elevated levels of bacteria. Tributaries of the Little River include Big Elm Creek and San Gabriel River, which spread across three counties including, Bell, Milam, and Falls. Recently, the Texas Commission on Environmental Quality (TCEQ; 2014) deemed Big Elm Creek unusable for recreational use. Recreational use, or primary contact recreation, is defined by the TCEQ (2014) as any "activities that are presumed to involve significant risk of ingestion of water" (p. 18) including, swimming, diving, canoeing, and other water activities (TCEQ, 2014b). The bacteria used to determine if a waterbody is unsafe for recreational use is an indicator of the pathogen that if ingested can increase the possibility of contracting an illness. Such illnesses can include gastrointestinal illness, as well as respiratory, eye, and neurologic complications (Lewis, n.d.).

Reduction of pollution is needed to keep humans and animals safe in the Little River watershed. To mitigate pollution in this area, the Texas Water Resources Institute partnered with the TCEQ to create a WBP. Implementing WBPs in Bell, Milam, and Falls counties will educate landowners in the area about BMPs that can reduce pollution entering the watershed. To effectively diffuse information to landowners and achieve successful adoption of BMPs, research was conducted to assess factors mentioned in the review of literature. The goal of this project was to effectively educate landowners about

water quality and encourage adoption of BMPs, in an effort to ultimately reduce contamination of pollution entering the Little River watershed.

Purpose and Objective

The purpose of this study was to identify motivations for and barriers to adopting BMPs related to WBPs. The purpose was achieved using two research objectives and six research questions.

1. Describe landowners' demographic and general land management/ownership and opinions regarding water quality.
    a. What is the current land management/ownership of landowners in the area?
    b. What agricultural commodities are produced on landowners' property?
    c. How much household net income results from agricultural commodities produced on landowners' property?
    d. What are the opinions of landowners regarding water quality?
2. Describe landowners' motivations for and barriers to adopting BMPs related to WBPs.
    a. What factors motivate landowners to adopt and implement BMPs related to water quality?
    b. What barriers keep landowners from adopting and implementing BMPs related to water quality?

Method

The method described herein was part of the reporting for a larger thesis research project, "Identifying Texas landowners' preferred communication channels, motivations, and barriers to adopting best management practices related to watershed based plans" (Dewald, 2016). A complete description of the research method for this study is described below.

Study Design

A quantitative approach was used to assess landowners' motivation for and barriers to adopting BMPs associated with watersheds management plans. This approach addressed the goals of the study by establishing facts, showing relationships, generalizing, and statistically describing the target population (Bryman, 2012; Rayfield, 2015). This method allowed quantifiable description of the sample and allowed for generalizability to the whole population. However, it is recognized that quantitative research does fail to provide explanation and further description of participants' thoughts (Bryman, 2012). For example, quantitative research does not allow for observation of the participant and emotional expression of their answers, which can provide further insight into the reasoning of their answer.

The instrument, including a booklet-style questionnaire, was designed and delivered to the sample using Dillman's Tailored Design method (2014). The social exchange theory framework was used for the development of the instrument (i.e., encouraging participation through the establishment of trust, increasing benefits, and decreasing costs to the participant). Because this quantitative method did not use

observation or nonverbal communication of the participant, Dillman et al. (2014) suggested qualitative methods should follow. The social exchange theory states that the researcher should earn the trust of the participant, show the benefits of participating in the study, as well as communicate the rewards associated, through written communication (Dillman et al., 2014). For example, logos provided legitimacy of the study and return postage encouraged participation.

Population and Sampling

The target population of this study included landowners within Bell, Milam, and Falls counties, within the Little River watershed, along the Little River, San Gabriel River, and Big Elm Creek, where specifically the Big Elm Creek is impaired for excessive levels of bacteria (TCEQ, 2014a). The need to provide landowners with information related to improving water quality is crucial to reduce bacteria levels.

In the selected counties, U.S. Ag Census (2012b) reported the average age of Caucasian principal operators of agricultural operations, or individuals who make land management decisions, was 57.2 in Bell County, 58.4 in Milam County, and 56.9 in Falls County. The average age of women operators was 58.5 in Bell County, 61.9 in Milam County, and 59.5 in Falls County. The average age of Spanish, Hispanic, or Latino operators was 53.5 in Bell County, 52.6 in Milam County, and 53.5 in Falls County. The average age of African American operators was 61.1 in Bell County, 64.7 in Milam County, 62.6 in Falls County. No data was available regarding the average age of Asian American operators in Bell, Milam, or Falls Counties.

Additionally, Caucasian principal operators managed/owned 415,044 acres in Bell County, 512,554 acres in Milam County, and 373,519 acres in Falls County. Spanish, Hispanic, or Latino principal operators managed/owned 7,207 acres in Bell County, 15,385 acres in Milam County, and 10,971 acres in Falls County. African American principal operators managed/owned 1,983 acres in Bell County, 8,752 acres in Milam County, and 6,383 acres in Falls County. Asian American principal operators managed/owned 489 acres in Bell County, 1,254 acres in Milam County, and zero acres in Falls County (U.S. Ag Census, 2012a). Additionally, women principal operators managed/owned 30,890 acres in Bell County, 35,427 acres in Milam County, and 22,344 acres in Falls County (U.S. Ag Census, 2012a). Although census data provided an estimate of demographic and land use data across the target counties, it represented areas outside of the watershed in rural and urban areas. Across the Little River watershed, San Gabriel River, and the Big Elm Creek combined had 50, 988 acres of developed land, 418, 506 acres of pasture or grazing land, 214, 231 acres of cultivated crops, 1,269 acres of barren land, and 28, 242 acres of wetlands (TWRI,2016a).

I obtained the sample population from county tax assessor's offices in Bell, Milam, and Falls counties where files provided contained Global Positioning System (GPS) coordinates. Using Geographic Information Systems (GIS), coordinates that fell inside city boundaries and outside the watershed boundaries were removed from the overall database. From here, duplicate addresses were removed, resulting in a population of 7,592. Using a simple random sampling method to ensure an equal probability of individuals within the population being selected into the sample (Bryman, 2012), I

assigned a random number to each address in the database and sported the random numbers from lowest to highest. I obtained the sample frame by selecting the first 1,881 addresses, which was based on an online sample calculator using a 95% confidence level and a 1.96 confidence interval.

Only one known questionnaire was undeliverable, thus 1,880 questionnaires were deliverable. There was an overall response rate of 25% (N =462) after all four points of contact. Participants returned a total of 217 questionnaires during the first round of data collection, and the number increased to 245 during the second round of data collection. Additionally, 21 respondents participated online, and three respondents opted not to participate online. A total of 254 respondents participated via mail, and 187 respondents opted not to participate via mail. A 15% (N=275) response rate resulted. Furthermore, to account for non-response, a comparison of early to late respondents was conducted and no statistical difference was found (Lindner, Murphy, & Briers, 2001). This response rate is typical of research in Texas (Berthold, 2014).

Demographic characteristics of the 275 participants residing along the Little River, San Gabriel River, and Big Elm Creek are shown in Table 17. Of those participants, 28.4% reported to be 55 to 64 years of age (n = 78), 67.3% male (n = 185), 83.6% Caucasian ethnicity (n = 230), and 24.0% reported to have a bachelor's degree (n = 66).

Table 17

Demographic Characteristics of Participants in the Little River Watershed who Selected to Participate in the Study Focused on Motivations for and Barriers to Adopting Best Management Plans Related to Watershed Based Plans (N= 275)

Characteristics	*n*	*%*
Age		
54 or younger	52	18.9
55 to 64	78	28.4
65 to 74	73	26.5
75 or older	55	20.0
Gender		
Male	185	67.3
Female	80	29.1
Ethnicity		
American Indian	1	.4
Asian	1	.4
Black or African American	19	6.9
Native Hawaiian or Pacific Islander	0	0
Spanish, Hispanic, Latino	3	1.1
White or Caucasian	230	83.6
Highest level of education		
Less than high school	6	2.2
High school diploma/GED	47	17.1
Some college	46	16.7
2 year degree	30	10.9
Bachelor's degree	66	24.0
Graduate Degree	58	21.1
Other	10	3.6

Instrument

The instrument was designed and administered based on Dillman's Tailored Design (Dillman et al., 2014) postal research method. A booklet-style questionnaire titled "Your perceptions on watershed management in your area" was mailed to the sample, along with an optional web-link to fill out the questionnaire online via a computer or mobile phone. Instrument questions were adapted and modified from

previous literature (Berthold, 2014; Peterson, 2014; Rosenberg & Margerum, 2008). Interviews with Texas A&M AgriLife Extension Agents in Bell, Milam, and Falls counties and the Social Indicators Data Management and Analysis Tool (SIDMA) website (Genskow & Prokopy, 2011) also assisted in creating a relatable questionnaire.

To assess landowners' motivations and barriers to adopting BMPs, seven of the 24 questions specifically assessed landowners' current participation in incentive programs, their motivations toward adopting BMPs related to improving water quality, and their likelihood in adopting WBPs. Close-ended questions with nominal dichotomous (i.e., yes or no) and ordinal Likert scales (i.e., four or five point) were used. General agricultural background questions assessed landowners' management and ownership of the land, amount of land owned, commodities produced and years of land management.

To ensure participants held similar understanding of the terms used throughout the questionnaire, I provided the following statements: (a) best management practices: effective methods of managing your property to achieve quality use and production of your land and mitigate environmental pollution (e.g., buffer strips, rotational grazing, etc.); and (b) incentive programs: financial funding provided to landowners who contract with agencies to implement best management practices. A nominal dichotomous (i.e.,, yes or no) scale assessed landowners' previous knowledge of these terms.

To assess motivation, landowners were asked to "indicate [their] level of agreement regarding the factors that influence [their] adoption of BMPs." Thirteen statements regarding economic, intrinsic, and knowledge factors were provided, and a

modified Likert-type five-point scale (i.e., strongly disagree, disagree, somewhat agree, agree, strongly agree) evaluated their agreement. To determine the barriers to adopting BMPs, landowners were asked to "indicate [their] level of agreement regarding the factors that have kept [them] from adopting BMPs." Fourteen statements regarding economic, intrinsic, and knowledge factors, and a Likert-type five-point scale (i.e., strongly disagree, disagree, somewhat agree, agree, strongly agree) evaluated their agreement. At the end of the questionnaire, participants were asked demographic questions (i.e., ethnicity, education level, gender, and year of birth). An optional open-ended question for participants to include additional comments about water-related topics was included at the end of the questionnaire.

Validity, or true measurement of the concept, was obtained through three main sources (Bryman, 2012). Scientists at the Texas Water Resource Institute (TWRI), extension agents in Bell, Milam, and Falls counties, and the SIDMA website, a database of survey questions related to landowners' adoption of WBPs. Reliability, or consistency of measurement, was attempted with a pilot test. However, because of an invalid response rate, it was not used as a source of reliability. Instead, reliability was assessed across two questions with 13 variables, using post hoc Cronbach's alpha ($\alpha = .969$; $\alpha = .905$; Field, 2013).

Self-completion, mail questionnaire method was used. This method was beneficial to the researcher because little time is spent physically administering the questionnaire, and it is also convenient for participants to respond (Bryman, 2012). Disadvantages of this method include the following: participant may read ahead in the

questionnaire, the questionnaire may become lengthy, there is potential for missing data, and it may result in a limited response rate (Bryman, 2012). Participants were also provided the option to use a website link to complete the questionnaire online (Bryman, 2012). The Qualtrics survey system allowed participants to complete the questionnaire using a computer or mobile device. Providing both postal and web-based methods allowed participants personal preference and usability when filling out the questionnaire (Dillman et al., 2014; Bryman, 2012). No item or monetary incentive was used to encourage participation in this study. Additionally, individuals who did not want to participate sent back questionnaire with their address notifier included, were removed from the data list, and were reported in the response rate.

Data Collection

Following Dillman's Tailored Design (Dillman et al., 2014) method, 1,881 questionnaires were mailed to the sample. On June 24, 2016 an initial postcard was mailed notifying participants why they were selected to participate, information regarding the study, and the link to participate in the questionnaire online. On July 1, 2016, the booklet questionnaire, cover letter, information sheet, and return envelope were mailed. The cover letter informed participants of the study and how their participation would help improve water quality in their area. The information sheet provided assurance of confidentiality, contact information, and informed the participants of the risks, benefits, and costs for participating in the study. The second postcard was mailed on July 8, 2016, as a "Thank You" for participating and a reminder to fill out the questionnaire. The final questionnaire, cover letter, and information sheet was mailed on

August 6, 2016, to those who had not replied to the initial questionnaire. Collection of returned questionnaires ended on August 12, 2016. During the collection of data, 122 initial postcards were undeliverable because of mailing complications (e.g., addressee not at address, addressee temporarily away, vacant address, closed P.O. Box). I cannot ensure all 122 of the participants also received the questionnaire, because return postage was not requested. Therefore, the 122 participants were not removed from the sample.

Data Analysis

Analysis for the data was performed through Version 23 of the Statistical package for Social Sciences (SPSS). I calculated descriptive statistics (i.e., mean, standard deviation, and number of responses) on measureable variables, and ran frequencies and percentages on demographic data (i.e., age, gender, ethnicity, and education level). *T*-tests were calculated to find associations or relationships among categorical data, and Bonferroni corrections were calculated accordingly (Bryman, 2012; Field, 2013).

Results

General Background Information of Landownership

A majority of the participants reported owning land in one of the three counties and producing agricultural commodities on the land (n = 108, 39.9%) or owning land and not producing agricultural commodities on the land (n = 82, 30.3%; see Table 18).

Table 18

Participants' Land Management/ownership in Bell, Milam, and Falls Counties (N = 275)

Management/Ownership	*n*	*%*
Own land in the area and produce agricultural commodities on it	108	39.9
Own land but do not produce agricultural commodities on it	82	30.3
Own land in the area but lease it to someone else	60	22.1
Other	13	4.8
Do not own land in the area	4	1.5
Lease land in the area and produce agricultural commodities on it	4	1.5

Of commodities produced on land participants owned or leased, 50% of participants raised livestock (*n* = 140) and 38.8% produced hay (*n* = 106; see Table 19).

Table 19

Participants' Reporting of Commodities Produced on Land in Bell, Milam, and Falls Counties (N = 275)

	Yes		*No*	
Commodities	*N*	*%*	*n*	*%*
Livestock	140	50.9	135	49.1
Hay	106	38.5	169	61.5
Wildlife	62	22.5	213	77.5
Row crops	56	20.4	219	79.6
Other	41	14.9	234	85.1

Note. N = total respondents who participated in the study. n = total participants who answered the question.

Almost half of the participants reported not earning an annual household income from production of agricultural commodities (*n* = 130, 48.7%) and 37.5% (*n* = 100) of

participants reported to earn one to 20% of their annual income from production of agricultural commodities (see Table 20).

Table 20

Participants' Reporting of Approximate Percentage of Household Net Income from Production of Agricultural Commodities (N= 275)

Percentage of household net income	*n*	*%*
0%	130	48.7
1 – 20%	100	37.5
21 – 40%	13	4.9
81 – 100%	12	4.5
41 – 60%	6	2.2
61 – 80%	6	2.2

Note. N = total respondents who participated in the study. n = total participants who answered the question.

Landowners' Opinions about Water Quality

Participants reported water quality in their area as very important (M = 1.16, SD = .38) and believed water quality status in their area was average (M = 1.96, SD = .62). Lastly, participants reported the future of water quality in their area to stay the same (M = 2.08, SD = .62; see Table 21).

Table 21

Participants' Opinion Regarding Water Quality (N= 275)

Statement	*M*	*SD*	*n*
Importance of water quality in your area	1.16	.38	267
Current status of water quality in your area	1.96	.62	258
Future of water quality in your area	2.08	.62	260

Note. 1. ≤1.50 = very important; 1.51 – 2.49 = important; 2.50 ≤ = not important; 2. ≤1.50 = above average; 1.51 – 2.49 = average; 2.50 ≤ = below average; 3. ≤1.50 = improving; 1.51 – 2.49 = staying the same; 2.50 ≤ = deteriorating.

Participants reported being most concerned with drought (*M* = 3.46, *SD* = .71) and only slightly concerned with sedimentation (*M* = 2.36, *SD* = .99). Additionally, participants who reported being concerned with issues besides those listed were concerned about agricultural chemical runoff carried out in river systems, cattle waste going into creek, contamination in the river from City of Temple run off, city sewage draining in rivers, streams, watersheds, over use of fertilizers, E. Coli, field erosion, lack of terracing, government action, trees as a crop to decrease erosion, surface reservoir construction, government ruining the Little River, upstream damming, and vegetation removal (see Table 22).

Table 22

Participants' Level of Concern with Surface Water Issues (N= 275)

Statement	*M*	*SD*	*n*
Drought	3.46	0.71	263
Pollution	3.04	0.93	257
Other	2.93	1.40	29
Not enough restoration efforts	2.78	0.93	250
Stream bank erosion	2.66	1.01	253
Flooding	2.56	1.08	255
Sedimentation	2.36	0.99	250

Note. ≤1.50 = not concerned; 1.51– 2.49 = slightly concerned; 2.50 – 3.49 = concerned; 3.50 ≤ = very concerned.

Participants' Current Awareness, Familiarity, and Implementation of Best Management Practices

Before completing the questionnaire, 60.8% of participants were unaware of the term best management practices (*f* = 104), 48.7% (*f* = 130) were unaware of efforts to control water pollution through best management practices, and 58.1% were unaware of the term incentive program (*f* = 154; see Table 23).

Table 23

Participants' Awareness of Best Management Practices Prior to Completing Questionnaire (N= 275)

	Yes		*No*		
Statement/Term	*f*	%	*f*	%	*n*
Aware of the term best management practice	161	39.2	104	60.8	265
Aware of efforts to control water pollution through best management practices	137	51.3	130	48.7	267
Aware of term incentive program	111	41.9	154	58.1	265

Note. N = total respondents who participated in the study. *n* = total participants who answered the question. *f* = number of participants who reported a usable answer.

Participants reported to be somewhat familiar with soil testing (*M* = 2.09, *SD* = .72) and terraces (*M* = 2.09, *SD* = .80) as best management practices. Participants also reported to not at all be familiar with variable rate application technology (*M* = 1.43, *SD* = .66) and riparian management (*M* = 1.16, *SD* = .71) as best management practices (see Table 24).

Table 24

Participants' Familiarity with Best Management Practices. (N= 275)

Best Management Practice	*M*	*SD*	*n*
Soil testing	2.09	.72	250
Terraces	2.09	.80	242
Pesticide management	2.05	.76	239
Wildlife management program	1.88	.70	246
Conservation tillage (no-till, strip-till)	1.87	.75	241
Retaining crop residue on soil surface	1.78	.79	241
Nutrient management	1.77	.96	238
Approved grazing management plan for livestock	1.74	.73	243
Fencing around riparian areas for rotational grazing	1.73	.75	240
Variable rate application technology	1.43	.66	240
Other	1.27	.59	15
Riparian management	1.16	.71	236

Note. ≤1.50 = not at all familiar; 1.51 – 2.49 = somewhat familiar; 2.50 ≤ = very familiar.

Additionally, participants reported which of the best management practices they implemented (see Table 24). Almost half of the participants implemented pesticide management practices (*n* = 109, 49.8%), and a majority of participants had not

implemented riparian management (*n* = 186, 89.4%) or variable rate application technology (*n* = 182, 88.8%).

Table 25

Participants' Best Management Practices Implemented (N= 275)

	Yes		*No*		
Best Management Practice	*f*	%	*f*	%	*n*
Pesticide management	109	49.8	110	50.2	219
Soil testing	85	36.3	149	63.7	234
Nutrient management	77	36.0	137	64.0	214
Retaining crop residue on soil surface	77	36.8	132	63.2	209
Terraces	67	30.6	152	69.4	219
Approved grazing management plan for livestock	59	27.8	153	72.2	212
Conservation tillage (no-till, strip-till)	52	24.0	165	76.0	217
Wildlife management program	50	22.9	168	77.1	218
Fencing around riparian areas for rotational grazing	49	23.1	163	76.9	212
Riparian management	23	11.2	182	88.8	205
Variable rate application technology	22	10.6	186	89.4	208
Other	2	15.4	11	84.6	13

Note. *N* = total respondents who participated in the study. *n* = total participants who answered the question. *f* = number of participants who reported a usable answer.

None of the participants who had implemented best management practices considered themselves successful, and many of them considered the practices somewhat successful (see Table 25). For example, participants who implemented pesticide management practices were somewhat successful (*M* = 2.08, *SD* = .71), and those who had implemented riparian management were also somewhat successful (*M* = 1.51, *SD* = .71; see Table 26).

Table 26

Participants' Successful Adoption of Best Management Practices (N= 275)

Best Management Practice	*M*	*SD*	*n*
Pesticide management	2.08	.71	124
Retaining crop residue on soil surface	2.00	.74	103
Terraces	1.93	.82	99
Nutrient management	1.87	.72	110
Soil testing	1.85	.65	123
Approved grazing management plan for livestock	1.81	.76	100
Conservation tillage (no-till, strip-till)	1.79	.72	96
Fencing around riparian areas for rotational grazing	1.74	.79	86
Wildlife management program	1.72	.71	89
Variable rate application technology	1.57	.74	76
Riparian management	1.51	.71	110
Other	1.25	.46	8

Note. ≤1.50 = not at all successful; 1.51 – 2.49 = somewhat successful; 2.50 ≤ = very successful

Of the participants who reported using incentive programs, 8.0% have used, or are currently using the Environmental Quality Incentives Program (*f* = 20), and 7.1% are using the Conservation Reserve Program (*f* = 18). Additionally, 6.8% (*f* = 41) of participants reported other, which included self-funded to avoid government regulation, local bank because of low interest rate, and Soil Conservation Service Cost-Share program. Additionally, one participant wanted more information about using local incentive programs (see Table 27).

Table 27

Participants' Use of Types of Incentive Programs (N= 275)

	Yes		*No*		
Incentive programs	*f*	%	*f*	%	*n*
Other	41	6.8	3	93.2	44
Environmental Quality Incentives Program	20	8.0	229	92.0	249
Conservation Reserve Program	18	7.1	234	92.9	252
Water Quality Management Plan	4	1.6	249	98.4	253
Landowner Incentive Program	3	1.2	245	98.8	248

Note. N = total respondents who participated in the study. n = total participants who answered the question. f = number of participants who reported a usable answer.

Factors that Influence Landowners' Adoption

Factors influential to participants' decisions to adopt best management practices, including economic, willingness to change, intrinsic, and social motivators, were divided into constructs. Participants reported they were influenced to adopt best management practices that were economically profitable (M = 4.19, SD = .94), would improve or maintain the environment for future generations (M = 4.19, SD = .94), aligned with their personal values and connection with the land (M = 4.12, SD = 1.00), and increased the property value of their land (M = 4.05, SD = 1.02). Participants were less influenced by loans that eased the cost of implementing the practice (M = 3.09, SD = 1.05; see Table 28).

Table 28

Factors that Motivate Participants to Adopt Best Management Practices (N= 275)

Factors	*M*	*SD*	*n*
Economic			
How economically profitable the practice is	4.19	.94	230
Increasing property value of my land	4.05	1.02	233
Cost-share programs to off-set the cost of implementing practices	3.38	1.1	232
Loans to help ease the cost of implementing Practices	3.09	1.05	230
Willingness to change			
Seeing other landowners be successful in implementing practices	3.70	.96	224
How relatable the practice is to my current management situation	3.52	.93	224
Intrinsic motivators			
Personal values and connection with the land	4.12	1.00	232
Pride of conserving your land by implementing practices	3.96	.98	229
Improving scenic beauty of my land	3.96	1.08	231
Social motivators			
Concern for neighbor's land	3.86	.99	233
Personal recognition of implementing practices	3.27	1.09	266
Improve/maintain the environment for future generations	4.19	.94	230
Improving wildlife/fish habitat	4.00	1.02	231
Other	3.40	1.55	15

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

An independent *t*-test was used to compare factors that influence participants to adopt BMPs between male (n = 169) and female (n = 90) participants. Based on the Bonferroni-corrected test value (α = .49), there were no significant differences between male and female participants' factors that influence them to adopt BMPs ($t(102.836)$ = .089, p = .053). Male participants (M = 4.17, SD = .88) reported to be more influenced to adopt best management practices if the practice improved or maintained the environment

for future generations than females were (*M* = 3.26, *SD* = 1.09). However, females (*M* = 4.15, *SD* = 1.13) reported to be more influenced by personal values and connection with the land then males were (*M* = 4.11, *SD* = .96). Both males (*M* = 3.04, *SD* = 1.04) and females (*M* = 3.20, *SD* = 1.07) reported to be less influenced by loans that helped ease the cost of implementing best management practices (see Table 29).

Table 29

Participants' Gender in Relation to the Factors that Motivate them to Adopt Best Management Practices (N= 275)

	Male			*Female*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*
Economic						
Increasing property value of my land	4.06	.99	165	4.02	1.13	66
How economically profitable the practice is	3.68	.91	162	3.68	1.07	63
Cost-share programs to off-set the cost of implementing practices	3.36	1.05	163	3.42	1.22	67
Loans to help ease the cost of implementing practices	3.04	1.04	162	3.20	1.07	66
Willingness to change						
Seeing other landowners be successful in implementing practices	3.70	.94	160	3.71	1.04	65
How relatable the practice is to my current management situation	3.51	.87	162	3.55	1.08	60
Intrinsic motivators						
Personal values and connection with the land	4.11	.96	162	4.15	1.13	67
Improving scenic beauty of my land	3.99	1.01	163	3.89	1.24	66
Pride of conserving your land by implementing practices	3.96	.96	162	3.94	1.06	65
Social motivators						
Concern for neighbors' land	3.86	.99	164	3.88	1.04	67
Personal recognition of implementing practices	3.26	1.06	162	3.29	1.19	62

Table 29 Continued

Factors	*Male*			*Female*		
	M	*SD*	*n*	*M*	*SD*	*n*
Improve/maintain the environment for future generations	4.17	.88	163	3.26	1.09	65
Improving wildlife/fish habitat	4.03	.97	161	3.93	1.12	68
Other	3.89	1.05	9	2.67	1.97	6

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

Additionally, participants who reported to own land and produce agricultural commodities on it were more motivated by best management practices that improved or maintained the environment for future generations (*M* = 4.27, *SD* = .82). Participants who owned their land but did not produce agricultural commodities on it were more motivated by best management practices that increased the property value of their land (*M* = 4.04, *SD* = 1.07; see Table 30).

Table 30

Participants' Land Management/ownership in Relation to Factors that Motivate them to Adopt Best Management Practices (N= 275)

	Do not own land in the area			*Own land and produce commodities*			*Own land – do not produce commodities*			*Own land – lease to someone else*			*Lease land and produce commodities*			*Other*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Cost-share programs to off-set the cost of implementing practices	3.00	-	1	3.38	1.10	101	3.23	1.00	64	3.59	1.17	51	3.00	1.63	4	3.70	1.06	10
Loans to help ease the cost of implementing practices	3.00	-	1	3.14	1.01	100	3.14	1.06	63	2.88	1.14	51	3.75	0.96	4	3.20	0.79	10
Improve/maintain the environment for future generations	4.00	-	1	4.27	0.82	98	4.02	1.10	65	4.25	0.95	51	4.25	0.50	4	4.20	1.03	10
How economically profitable the practice is	3.00	-	1	3.75	0.94	99	3.48	0.99	62	3.82	0.95	51	4.00	0.82	4	3.60	0.97	10
Seeing other landowners be successful in implementing practices	4.00	.00	2	3.65	0.85	97	3.68	1.12	63	3.71	1.03	51	4.00	0.82	4	4.10	0.74	10
Pride of conserving your land by implementing practices	5.00	-	1	4.01	0.94	97	3.86	1.07	66	3.90	0.97	50	3.75	0.96	4	4.20	0.92	10
Personal recognition of implementing practices	3.00	-	1	3.22	1.16	98	3.34	0.96	65	3.13	1.12	48	3.50	1.00	4	3.80	1.14	10
How relatable the practice is to my current management situation	4.00	-	1	3.59	0.86	99	3.27	0.97	62	3.67	0.95	48	3.75	0.96	4	3.60	1.08	10
Improving wildlife/fish habitat	5.00	-	1	4.13	0.89	100	3.88	1.15	65	3.88	1.12	51	3.50	0.58	4	4.20	0.92	10

Table 30 Continued

	Do not own land in the area			*Own land and produce commodities*			*Own land – do not produce commodities*			*Own land – lease to someone else*			*Lease land and produce commodities*			*Other*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Improving scenic beauty of my land	5.00	-	1	4.07	0.94	100	3.94	1.20	66	3.78	1.19	51	3.33	0.58	3	4.00	1.05	10
Increasing property value of my land	5.00	-	1	4.15	0.88	100	4.04	1.07	67	3.83	1.23	52	4.25	0.96	4	4.11	0.93	9
Personal values and connection with the land	5.00	-	1	4.24	0.87	100	4.00	1.12	66	4.04	1.10	51	4.50	0.58	4	3.90	1.10	10
Concern for neighbors' land	4.00	-	1	3.95	0.89	100	3.82	1.08	66	3.71	1.05	51	4.25	0.50	4	3.80	1.40	10
Other	-	-	0	4.25	0.96	4	2.71	1.50	7	3.00	2.83	2	-	-	0	4.50	0.71	2

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

An independent *t*-test was used to compare participants' reported factors that influence them to adopt BMPs, between Caucasian (*n* = 209) and other ethnicities (n = 20). Based on the Bonferroni-corrected test value (α = .49), there was significant differences between Caucasian and other ethnicities (*t*(20.45) = -.320, *p* = .007). Caucasian participants reported to be more motivated to adopt best management practices that improved or maintained the environment for future generations (*M* = 4.20, *SD* = .92) than were participants from all other ethnicities (i.e., American Indian, Asian, Black or African American, Native Hawaiian or Pacific Islander, Spanish, Hispanic, Latino) (*M* = 4.00, *SD* = 1.29). However, participants from all other ethnicities were motivated by concern for neighbors' land (*M* = 4.17, *SD* = .78) than were Caucasian participants (*M* = 3.81, *SD* = 1.02; see Table 31).

Table 31

Participants' Ethnicity in Relation to the Factors that Motivate them to Adopt Best Management Practices (N= 275)

	Caucasian/White			*All Other Ethnicities*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*
Economic						
Increasing property value of my land	4.04	1.03	205	4.06	1.06	18
How economically profitable the practice is	3.68	.96	199	3.61	1.15	18
Cost-share programs to off-set the cost of implementing practices	3.39	1.08	201	3.53	1.31	19
Loans to help ease the cost of implementing practices	3.08	1.01	201	3.18	1.43	17
Willingness to change						
Seeing other landowners be successful in implementing practices	3.68	.97	200	4.00	1.03	18
How relatable the practice is to my current management situation	3.53	.91	197	3.56	1.04	18
Intrinsic motivators						
Personal values and connection with the land	4.12	1.02	203	4.00	1.03	18
Improving scenic beauty of my land	3.96	1.08	203	3.89	1.08	18
Pride of conserving your land by implementing practices	3.96	.98	201	3.89	1.08	18
Social motivators						
Concern for neighbors' land	3.81	1.02	204	4.17	.78	18
Personal recognition of implementing practices	3.21	1.10	199	3.67	1.03	18
Improve/maintain the environment for future generations	4.20	.92	201	4.00	1.29	18
Improving wildlife/fish habitat	4.00	1.03	202	4.00	1.09	18
Other	3.64	1.36	11	2.00	1.73	3

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

Factors Landowners Consider as Barriers

Factors landowners considered barriers to participants' decisions to adopt best management practices, including economic and knowledge, were divided into

constructs. Participants reported barriers to adoption to include being unsure of government regulations and rules associated with implementing best management practices (M = 3.75, SD = .99), lacking information about the effectiveness of the best management practice (M = 3.67, SD = .99), and not knowing about the incentive programs (M = 3.66, SD = 1.09). These three factors were within the knowledge construct. Additionally, participants considered initial cost of implementation (M = 3.61, SD = 1.03) as a barrier but did not considered what neighbors would think (M = 2.39, SD = 1.06) as a barrier (see Table 32).

Table 32

Factors Participants Considered Barriers to Adopting Best Management Practices (N= 275)

Factors	*M*	*SD*	*n*
Economic			
Initial cost of implementation	3.61	1.03	208
Maintenance costs	3.54	0.98	209
Incentive (cost-share) levels are too low	3.44	1.04	198
Uncertain if the practice will increase or decrease production profits	3.41	0.93	203
Knowledge			
Unsure of government regulations and rules associated with implementing practices	3.75	0.99	211
Lack of information about how effective the practice is	3.67	0.99	208
I did not know about incentive programs	3.66	1.09	213
Lack of opportunities to see demonstrations of the practices	3.58	0.95	207
Terms of the program contract	3.25	0.96	194
Lack of support from agencies/organizations when implementing practices	3.36	1.02	199
Other	3.36	1.57	11

Table 32 Continued

Factors	*M*	*SD*	*n*
My land does not meet the requirements of the practice	2.94	1.07	196
Belief that adopting a practice will not make a difference	2.90	1.05	206
I do not want to change my current land management practices	2.84	1.09	209
Unsure of what my neighbors would think	2.39	1.06	202

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

An independent *t*-test was calculated to compare the identified factors that are considered barriers to adopting BMPs, between male (n = 161) and female (n = 64) participants. Based on the Bonferroni-corrected test value (α = .49), there was significant differences between male and female participants' the factors that were considered barriers to adopting BMPs ($t(95.49) = -.841$, $p = .047$). Male (M = 3.72, SD = .97) and female (M = 3.82, SD = 1.07) participants reported being unsure of government regulations and rules associated with implementing practices as barrier to adopting best management practices. Additionally, male (M = 2.37, SD = 1.07) and female (M = 2.45, SD = 1.18) participants being unsure of what their neighbors think was not a barrier to adopting best management practices (see Table 33).

Table 33

Participants' Gender in Relation to Factors Participants Considered Barriers to Adopting Best Management Practices (N= 275)

	Male			*Female*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*
Economic						
Initial cost of implementation	3.55	.98	150	3.75	1.18	56
Maintenance costs	3.48	.92	151	3.70	1.11	56
Uncertain if the practice will increase or decrease production profits	3.39	.90	148	3.49	1.01	53
Incentive (cost-share) levels are too low	3.38	1.02	143	3.56	1.09	52
Knowledge						
Unsure of government regulations and rules associated with implementing practices	3.72	.97	152	3.82	1.07	57
I did not know about incentive programs	3.68	1.07	152	3.58	1.18	59
Lack of information about how effective the practice is	3.65	.96	150	3.73	1.09	56
Lack of opportunities to see demonstrations of the practices	3.55	.92	150	3.67	1.04	55
Terms of the program contract	3.21	.94	142	3.35	1.04	51
My land does not meet the requirements of the practice	2.96	1.07	142	2.94	1.06	53
I do not want to change my current land management practices	2.89	1.09	150	2.74	1.10	58
Belief that adopting a practice will not make a difference	2.87	.99	149	3.00	1.20	55
Other	3.67	1.21	6	3.00	2.00	5
Lack of support from agencies/organizations when implementing practices	3.34	1.02	144	3.38	1.02	53
Unsure of what my neighbors would think	2.37	1.07	146	2.45	1.18	55

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

A one-way analysis of variance (ANOVA) was used to compare participants' reported land management/ownership status, among the identified factors that are considered barrier to adopting BMPs. Based on the Bonferroni-corrected test value (α =

.49), the effect of participants' reported land management/ownership status was not significant on their barriers to adopting BMPs ($F(5) = 1.21$, $p = .307$, 1- $\beta = .425$). Participants who owned land and produced agricultural commodities on it considered being unsure of government regulations and rules associated with implementing the practice ($M = 3.88$, $SD = .91$) a barrier to adopting best management practices and reported uncertainty of what their neighbors think to be less influential in their decision to adopt best management practices ($M = 2.28$, $SD = 1.01$). Participants who owned land but did not produce agricultural commodities on it reported not knowing about incentive programs ($M = 3.64$, $SD = 1.07$) as a barrier to adopting best management practices and also reported uncertainty of what their neighbors think to be less influential in their decision to adopt best management practices ($M = 2.78$, $SD = 1.08$; see Table 34).

Table 34

Land Management/Ownership in Relation to Factors Participants Considered Barriers to Adopting BMPs (N= 275)

	Do not own land in the area			*Own land and produce commodities*			*Own land – do not produce commodities*			*Own land – lease to someone else*			*Lease land and produce commodities*			*Other*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*N*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Initial cost of implementation	2.00	-	1	3.67	0.96	91	3.48	1.10	56	3.60	1.12	47	3.67	1.16	3	4.00	.94	10
Maintenance costs	2.00	-	1	3.63	0.89	92	3.41	1.07	54	3.52	1.05	48	3.25	1.26	4	3.70	.68	10
Incentive (cost-share) levels are too low	2.00	-	1	3.64	0.98	90	3.29	1.09	52	3.30	1.08	43	3.33	1.53	3	3.22	.83	9
Uncertain if the practice will increase or decrease production profits	3.00	-	1	3.52	0.86	90	3.28	0.96	54	3.34	.96	44	3.50	1.29	4	3.50	1.08	10
Terms of the program contract	2.00	-	1	3.43	0.95	87	3.10	0.96	52	3.23	.97	40	2.75	.50	4	2.67	.71	9
Unsure of government regulations and rules associated with implementing practices	3.00	-	1	3.88	0.91	92	3.46	1.05	57	3.85	1.03	46	3.25	1.26	4	4.00	.82	10
Lack of information about how effective the practice is	3.00	-	1	3.69	0.89	91	3.48	0.91	56	3.51	1.06	45	3.00	.00	4	3.80	1.23	10
Lack of opportunities to see demonstrations of the practices	2.00	-	1	3.74	0.91	91	3.54	1.04	57	3.74	1.04	46	2.25	1.26	4	3.78	1.20	9
Belief that adopting a practice will not make a difference	1.00	-	1	2.91	1.00	92	2.93	1.07	55	2.91	1.10	45	3.25	1.26	4	2.67	1.00	9
My land does not meet the requirements of the practices	2.00	-	1	2.73	1.02	85	3.42	1.08	55	2.80	.99	40	3.25	1.26	4	2.50	.850	10
I did not know about incentive programs	3.00	-	1	3.75	1.07	93	3.64	1.14	59	3.54	1.15	46	3.00	.82	4	3.80	1.03	10
Lack of support from agencies/organizations when implementing practices	2.00	-	1	3.58	0.98	92	3.39	1.02	51	2.95	1.02	41	2.75	.50	4	3.30	1.06	10

Table 34 Continued

Factors	*Do not own land in the area*			*Own land and produce commodities*			*Own land – do not produce commodities*			*Own land – lease to someone else*			*Lease land and produce commodities*			*Other*		
	M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*N*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Unsure of what my neighbors would think	1.00	-	1	2.27	1.01	88	2.78	1.08	55	2.18	1.02	44	1.75	.96	4	2.60	1.08	10
I do not want to change my current land management practices	2.00	-	1	2.71	1.01	90	3.07	1.18	57	2.74	1.06	46	3.25	1.26	4	2.90	1.20	10
Other	-	-	0	4.33	1.16	3	2.25	0.96	4	3.00	2.83	2	-	-	0	4.50	.71	2

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

An independent *t*-test was used to compare identified factors that are considered barriers to adopting BMPs, between Caucasian and other ethnicities. Based on the Bonferroni-corrected test value ($\alpha = .49$), there were no significant differences between Caucasian and other ethnicities ($t(214) = -.028$, $p = .336$). Caucasian participants considered being unsure of government regulations and rules associated with implementing best management practices ($M = 3.76$, $SD = .97$) more as a barrier to adoption than other ethnicities (i.e., American Indian, Asian, Black or African American, Native Hawaiian or Pacific Islander, Spanish, Hispanic, Latino) did ($M = 3.59$, $SD = 1.18$). However, other ethnicities were not as aware of incentive programs ($M = 3.82$, $SD = 1.13$) as Caucasian participants were ($M = 3.61$, $SD = 1.10$; see Table 35).

Table 35

Participants' Ethnicity in Relation to the Factors they Considered Barriers to Adopting Best Management Practices (N= 275)

	Caucasian/White			*All Other Ethnicities*		
Factors	*M*	*SD*	*n*	*M*	*SD*	*n*
Economic						
Initial cost of implementation	3.63	1.02	182	3.50	1.15	18
Maintenance costs	3.53	.95	182	3.72	1.07	18
Incentive (cost-share) levels are too low	3.45	1.03	173	3.44	1.15	16
Uncertain if the practice will increase or decrease production profits	3.40	.91	178	3.41	1.12	17
Knowledge						
Unsure of government regulations and rules associated with implementing practices	3.76	.97	183	3.59	1.18	17
Lack of opportunities to see demonstrations of the practices	3.67	.99	184	3.63	1.09	16
I did not know about incentive programs	3.61	1.10	187	3.82	1.13	17
Lack of information about how effective the practice is	3.56	.94	181	3.71	1.11	17

Table 35 Continued

Factors	*Caucasian/White*			*All Other Ethnicities*		
	M	*SD*	*n*	*M*	*SD*	*n*
Terms of the program contract	3.25	.95	169	3.13	1.20	16
Other	3.44	1.42	9	1.00	-	1
Lack of support from agencies/organizations when implementing practices	3.34	1.03	175	3.63	1.09	16
My land does not meet the requirements of the practices	2.95	1.05	169	3.17	1.10	18
Belief that adopting a practice will not make a difference	2.89	1.04	181	3.19	1.11	16
I do not want to change my current land management practices	2.85	1.05	185	2.65	1.17	17
Unsure of what my neighbors would think	2.33	1.01	178	3.12	1.22	17

Note. ≤1.50 = strongly disagree; 1.51–2.49 = disagree; 2.50–3.49 = somewhat agree; 3.50–4.49 = agree; 4.50 ≤ = strongly agree

Conclusions

The evaluating landowners' motivations for and barriers to adopting BMPs related to WBPs was conducted to help environmental organizations encourage adoption of BMPs and increase participation in WBPs within the Little River watershed. Participants' background information provided an understanding of the landowners along the Little River, San Gabriel Creek, and Big Elm Creek, and their motivations for and barriers to adopting BMPs will help organizations target specific information to those groups.

Participants in the area investigated considered water an important resource, believed the current status of water quality was important, and foresee water quality to stay the same in the future. Furthermore, participants were concerned with drought, pollution, not enough restoration efforts, stream bank erosion, and flooding. Although

participants found water quality important and were concerned with activities that affect water quality, they have not implemented a majority of the identified BMPs typically associated with WBPs. Additionally, a high percentage reported they had not accessed available incentive programs. Perhaps, this was because 55.1% of participants reported to not be aware of the term incentive program.

Knowledge, such as understanding the term incentive programs and BMPs, is the first stage individuals enter when starting the innovation-decision process of adopting new ideas (Rogers, 2010). Thus, the availability of information to landowners is necessary to begin the innovation-decision process. Along with knowledge about incentive programs, 60.8% of participants were unaware of the term BMPs and were somewhat or not at all familiar with the practices. This lack of knowledge suggests landowners in this area need information about BMPs and more specifically, information about the practices. Even more so, male and female participants agreed that lack of knowledge about BMPs was a barrier to implementing practices, which supported Molnar et al. (2001) and Rodriguez et al. (2009). Additionally, participants across land ownership, ethnicities, and gender, reported uncertainty of government regulations and rules associated with implementing practices was a barrier to adopting BMPs. Furthermore, participants across land ownership, ethnicities, and gender, reported not knowing about incentive programs as influential to not adopting BMPs.

Participants in this study also had unfavorable attitudes toward adopting BMPs because of initial cost of implementation and maintenance costs, which supported research from Berthold (2014), Perry-Hill and Propokpy (2014), and Rodriguez et. al

(2009). Although reported by all participants as less influential in adopting BMPs, uncertainty of what their neighbors think was less influential to males than females. This result contradicts results from Ryan and Deci (2000) who found societal pressures encouraged individuals to make a change in behavior Participants in this study reported ages in the range of 55 to 62 years of age. Additionally, most participants reported to not earn any household net income from agricultural commodities produced on their land; thus, implementing BMPs may not be a priority when making land management decisions.

Despite participants' reported barriers, they also reported to be influenced to adopt BMPs if the practice was economically profitable and if the practice increased the property value of their land. In contrast, participants reported to be less influenced to adopt BMPs by loans that helped ease cost of implementing practices. This discrepancy could be caused by participants not wanting to spend their money on practices implemented on land that does not generate income as 48.7% of the participants reported to not earn net household income from commodities produced on their land. Overall, however, economic factors were a high motivator and high barrier for adopting BMPs.

Participants were also influenced to adopt BMPs if the practice would improve or maintain the environment for future generations, which was reported as more influential by males than females, by Caucasian participants than other ethnicities, and by participants who owned their land and produced agricultural commodities on it. Although reported by all participants in the study as an influential factor in adopting BMPs, more female than male participants reported to be influenced by practices that

aligned with their personal values and connections with the land (Heath & Health, 2010; Rosenberg & Margerum, 2008; Sheeder & Lynne, 2011). Participants who owned their land but did not produce agricultural commodities were more influenced by BMPs that increased property value of their land. Furthermore, participants from all other ethnicities reported concern for their neighbors' land as influential in their decision to adopt BMPs.

Part of the implementation stage of Rogers (2010) innovation-decision process is the attempt to try the innovation. Although this study showed most participants have not implemented BMPs, participants had implemented pesticide management and soil testing more so than the other identified BMPs and reported pesticide management as somewhat successful. Therefore, those participants who had implemented the BMPs and have formed a somewhat successful perception of the innovation would possibly continue implementing the BMP.

Recommendations

Further researcher is recommended to be conducted through qualitative interviews with participants of this study. Discussion and dialogue from participants in the Little River watershed would enable a deeper understanding of the factors that motivate them to or keep them from adopting BMPs. Previous research has conducted qualitative interviews followed by focus group interviews with a portion of participants, which provided more detailed information regarding results of the quantitative survey (Rosenberg & Margerum, 2008). By obtaining a deeper understanding of landowners,

practitioners can better deliver information and educational opportunities more effectively as well as address problems they face when implementing BMPs.

Additionally, holistic understanding of the Little River watershed is needed to effectively understand and mitigate water quality problems. A systems thinking approach is encouraged to view all aspects of the watershed, including stakeholder observations, components of the system, and how the components and observation interact (Weinberg, 1975). This approach will identify all elements that make up the watershed, and provide opportunities to address the problems, ultimately producing a successful WBP.

Based upon the results of this study, outreach and education should be tailored to participants' motivations for adopting BMPs associated with WBPs. For example, preferred communication channels and types of information should incorporate the motivational factors that participants reported. Landowners will most likely be more apt to implement BMPs if they are influenced by education tailored to their motivational preferences and less by the factors they reported as less influential. Outreach and education should address economic opportunities provided by government agencies and include complete information about contract terms and conditions associated with the BMPs.

Knowledge is the first step in the innovation-decision process; thus, it is important landowners have access to information related to WPBs and BMPs (Rogers, 2010). Resources should be available to landowners throughout the process of adopting innovations like BMPs. Such resources should be communicated through preferred

communication channels, educational events and meetings, as well as Extension specialists or water resource technicians. Without such resources, landowners are more likely to discontinue implementation of best management practices throughout the process.

Limitations

As with most quantitative methods, not all motivational factors or factors were included in the instrument administration during this study. Although participants had the option to include factors that were not identified in the questionnaire, participants might not include all of the factors that actually influence them or hold them back from adopting BMPs. Additionally, 122 postcards were undeliverable to the sample because of invalid addresses. Envelopes including the questionnaire did not have a return service requested; thus, there was no knowledge of whether these individuals received the questionnaire.

CHAPTER IV

CONCLUSIONS

As America's population grows and the demand for food commodities increases, pollution from agricultural production will continue to be a priority. Thus, it is important to understand landowners and their barriers to adopting BMPs related to WBPs. Such an understanding will allow sources of water-related information to effectively deliver their messages and increase participation in the planning process of WBPs. Following Stone et al.'s (1999) information diffusion theory, water-related information can be delivered to target landowners in a watershed. The content and messages delivered to landowners can motivate individuals to adopt BMPs and encourage them to disregard the barriers, thus, inspiring landowners to begin Rogers's (2010) the innovation-decision process.

Landowners in the Little River watershed reported they do not receive water-related information, are not be familiar with the identified BMPs related to water quality, and consider knowledge to be the biggest barrier to adopting BMPs. Thus, it is important that, when creating and delivering the Little River WBP, landowners be informed about water quality in their area and how they can learn about and adopt BMPs. Providing educational opportunities, such as quarterly direct mailings, website updates, or emails, will help them become more knowledgeable about water quality and be informed about the Little River WBP. Kaplowitz and Lupi, (2012) suggested that including public landowners in the creation and evaluation of WBPs can be effective in their success. This can also reduce ambiguity and distrust, which can be associated with encouraging implementation of BMPs on personal property to benefit the environment. Additionally,

because participants reported Texas A&M AgriLife Extension, Texas Parks and Wildlife, industry representatives, and government agencies as somewhat trustworthy, they should be considered prominent stakeholders in delivering water-related information to landowners and to developing the WBP. This will assist in the trustworthiness and success of landowners' adoption of BMPs associated in the WBP.

Although landowners preferred all types of water-related information related to BMPs, they were particularly influenced by information that described economic profit or described the impact of improving to maintain the environment for future generations. Outreach and education should be based upon of these preferences to encourage participation and adoption of BMPs in the target watershed. Targeting landowners through the most influential or motivational internal factors can encourage them to obtain more knowledge (Knowles, Holton, & Swanson, 2015).

It is critical to inform landowners in the Little River watershed about water quality. Individuals who are knowledgeable about water quality and who have the opportunity to assist in the planning process of the WBP are more likely to adopt the BMPs. Ultimately, the adoption of BMPs have the potential to have a dramatically positive impact on the watersheds across the United States. This impact, in turn, will create healthy waterways for humans and animals. However, it is important to take regional differences into consideration as communication strategies and diffusion plans are implemented in order to have an effective impact on water quality across the United States.

Recommendations

Results of this study suggest that further research should be conducted after the implementation process of the regional Little River WBP. A post-test could be performed on the same sample to determine effectiveness of outreach, education, and adoption of BMPs related to WBPs, following Stone et al. (1999). Focus group interviews would be beneficial to allow further understanding of the motivations and barriers to adopting BMPs as landowners move through the innovation-decision process (Rogers, 2010).

Although social media was not found to be a preferred communication channel in this study, further research should be performed about social media related to WBPs. Technological advances associated with the Internet continue to emerge that directly impact how individuals receive and process information. Direct mailings and websites are no longer the only way to communicate short, specific, and assimilated messages to the public. Social media has become a quick and efficient means to deliver water-related information. Further, social media allows a consistent message with two-way conversation between the audience and the source.

Friends and neighbors was a source of information that was not considered trustworthy but was reported as trustworthy in other research (Rosenberg & Margerum, 2008; Morton, Bitto, & Brant, 2001)and considered an interpersonal communication tool to assist in the adoption of innovations (Rogers, 2010). Interviews with participants of this study would assist in understanding why friends and neighbors were not considered a trustworthy source in regard to information about water. Community involvement and

relationships with others could perhaps increase participation in WBPs and the adoption of BMPs.

The research regarding communication preferences and the motivations for and barriers to adopting BMPs related to WBPs should be combined. For example, it would be beneficial to communicate water-related messages that include participants' motivational factors—economic funding opportunities and educational seminars on the success of implementing BMPs. This could capture the landowners' attention, encourage them to seek further information, and adopt the BMPs.

As landowners begin and move through the innovation-decision process (Rogers, 2010), stakeholders should deliver educational information via websites, direct mailings, and Extension agents. This will help landowners move through the process. Again, the use of trustworthy sources would be beneficial to ensure landowners continue throughout the process. Additionally, further research involving the younger generation of landowners and how they communicate using 21st century technology would be beneficial and possibly encourage further adoption BMPs.

Additionally, observation research at stakeholder meetings about WBPs could help practitioners develop and create WBPs. As described by the EPA (2008), WBPs should include input from stakeholders (e.g., environmental organizations, businesses, landowners), thus, determining specific hurdles and discrepancies between organizations when creating plans can assist in understanding how to reduce misunderstanding and increase the effectiveness of delivering WBPs. Furthermore, addressing participants' willingness to participate in planning WBPs will also assist in increasing the adoption of

BMPs and the effectiveness of WBPs implementation. Understanding participants' motivations for seeking further education regarding water quality can assist the initial development of WBPs, which can further expand and increase participation in the development of WBPs and increase the adoption of BMPs

Approaching the development of WBPs with systems thinking approach (Weinberg, 1975), developers would identify the problem within the watershed, the various observations from stakeholders, the components of the system, and an understanding how each element interacts. This approach would take into consideration each stakeholders' perception, and efficiently and constructively communicate with each other to develop an effective WBP, thus increasing adoption of the plan. A systems thinking approach would combine the natural resource and engineering data, sociological, leadership, and communications aspects to thoroughly explore the complexity of the issues within the watershed and effectively create and implement a WBP.

Limitations

Although this study provided a representation of the preferred communication channels, motivations, and barriers, it is possible that not all of the variables or factors that landowners consider to be motivational factors or barriers to adopting BMPs were identified. Additionally, previous research has suggested that survey questions can elicit participants to underreport variables that are socially deemed as undesirable and over report variables that are seen as desirable (Krumpal, 2013). This can be considered an implication when questions ask participants to self-evaluate. Due to social pressures,

participants may answer questions in more extremes because they feel they will be punished or judged based on their answers.

Furthermore, when determining the instrument's reliability, a pilot test was employed. Due to poor response rate, the pilot study was not an accurate determination of reliability. When beginning data collection, 122 initial postcards were undeliverable due to invalid addresses. This limited the effectiveness of Dillman's Tailored Design Method (2014) because not all individuals in the sample received all points of contact. Additionally, participants were asked to include their mailing address in the questionnaire to be used as an identifier. Some of the participants included their address, and some participants did not. Thus, it was difficult to remove participants who did not want to participate. An identifier number printed on the questionnaire and paired to the participants' address is recommended for future studies.

Implications

This study will assist stakeholders with communicating to landowners within the Little River watershed in an effort to create healthy waters across the United States. It will directly benefit organizations such as TWRI and Texas A&M AgriLife Extension by informing them about how to effectively reach their audiences and deliver landowners' preferred types of water-related messages. Findings have the potential to encourage potential collaboration between agencies and organizations to create the WBP and effectively deliver information across audiences within the watershed. It is also important to continually assess the evolving process of creating a WBPs, including, building partnerships with stakeholders, gathering watershed data, finalizing goals and

identifying solutions, designing the plan, implementing the WBP, and measuring the progress (EPA, 2008).

Ultimately, this study will directly affect the Little River watershed planning process, outreach and education of water-related information, and the adoption of BMPs by landowners. The adoption of BMPs has the potential to greatly reduce pollutants entering Texas waterways, creating healthier waterways across the United States.

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APPENDIX A

INSTRUMENT

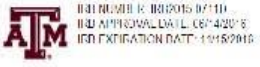
June 2016

Greetings. My name is Stacey, and I am a graduate student at Texas A&M University. A few days from now, you will receive a questionnaire participation request in the mail. The purpose of this questionnaire is to gain a better understanding of landowners' opinions about adopting watershed management practices and preferences for receiving water-related information.

I am writing in advance because we have found landowners prefer to be contacted before they receive a questionnaire. When you receive the questionnaire, I would appreciate you taking the time to complete the questionnaire to the best of your ability and mailing it back to me in the enclosed, prepaid envelope. If you prefer to complete the questionnaire online, you can at **littleriver.tamu.edu/evaluation**.

Thank you for your time and consideration. It's only with the generous help of landowners like you that research can be successful.

Sincerely,
Stacey Dewald
Graduate Student, Texas Water Resources Institute
sdewald@tamu.edu



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TEXAS A&M UNIVERSITY
AGRICULTURE & LIFE SCIENCES

TEXAS WATER RESOURCES INSTITUTE

July 2016

Greetings,

My name is Stacey, and I am a graduate student in the Department of Agricultural Leadership, Education, and Communications at Texas A&M University. I am working on a research project to understand landowners' perceptions about water quality, identify barriers to adoption of management practices, and understand communication preferences of water-related information in Bell, Milam, and Falls counties. This study is part of an effort to improve watershed management practices in the Little River, Big Elm Creek, and San Gabriel River watersheds. Results of this study will be used to help local and state water educators deliver relevant water-related educational information in your area and help reduce the barriers to adopting water management practices.

You are being contacted for this study because you own and/or operate land in Bell, Milam, or Falls counties. Although your participation is voluntary, your opinions are important to water quality improvement in the region. First, please read the enclosed information sheet. If you wish to participate, simply fill out the entire questionnaire and return in the prepaid envelope. To ensure you do not receive the questionnaire multiple times, we request you include the numbers in your mailing address at the beginning of the questionnaire, so we can remove your name from our mailing list once we receive your response. If for some reason you prefer not to participate, please write the numbers in your mailing address and return the blank questionnaire in the enclosed, prepaid return envelope, so we can remove you from our list. If you prefer to complete the questionnaire online, feel free to do so at **littleriver.tamu.edu/evaluation**.

Your questionnaire answers are confidential and will be released only as a summary in which no individual answers can be identified. Once we have received responses, the mailing list will be destroyed, so individual names cannot be linked to the results. Protecting the confidentiality of your answers is very important to us.

Your opinion and contribution is appreciated and will impact the way water-related information is delivered to landowners in your region. It's only with the generous help of people like you that our research can be successful.

Again, please read the information sheet and complete the questionnaire included in this packet. Then, return the questionnaire in the prepaid envelope by **August 8, 2016.** If you have any questions or comments about this study, please email me at sdewald@tamu.edu.

Thank you again for your time,

Stacey Dewald
Graduate Student, Texas Water Resources Institute
sdewald@tamu.edu

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IRB NUMBER: IRB2015-0711D
IRB APPROVAL DATE: 06/14/2016
IRB EXPIRATION DATE: 11/15/2016

Project Title: **Identify Preferred Communication Mediums for and barriers to Adopting Watershed Management Plans**

You are invited to take part in a research study being conducted by Stacey Dewald, a researcher from Texas A&M University and funded by the Texas Commission on Environmental Quality. The information in this form is provided to help you decide whether or not to take part. If you decide you do not want to participate, there will be no penalty to you, and you will not lose any benefits you normally would have.

Why Is This Study Being Done?
The purpose of this study is to identify preferred communication mediums for and barriers to adopting watershed management plans, in the Little River, San Gabriel, and Big Elm Watersheds.

Why Am I Being Asked To Be In This Study?
You are being asked to be in this study because own land within the Little River, San Gabriel, and Big Elm watersheds. We would like to understand your preferred communication mediums and barriers to adopting watershed management plans.

How Many People Will Be Asked To Be In This Study?
2,250 people (participants) will be invited to participate in this study locally.

What Are the Alternatives to being in this study?
No, the alternative to being in the study is not to participate.

What Will I Be Asked To Do In This Study?
You will be asked to fill out a questionnaire. This questionnaire will include questions about your preferred communication mediums and the barriers you face when adopting watershed management plans. Your participation in this study will last approximately 20 minutes.

Are There Any Risks To Me?
The things that you will be doing are no more risks than you would come across in everyday life.

Are There Any Benefits To Me?
The direct benefit to you by being in this study is the identification of preferred communication mediums for and barriers to adopting watershed management plans in the Little River, San Gabriel, and Big Elm Watersheds.

Will There Be Any Costs To Me?
Aside from your time, there are no costs for taking part in the study.

Will I Be Paid To Be In This Study?
You will not be paid for being in this study.

IRB NUMBER: IRB2015-0711D
IRB APPROVAL DATE: 04/04/2016
IRB EXPIRATION DATE: 11/15/2016

Will Information From This Study Be Kept Private?
The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Stacey Dewald, principal investigator, will have access to the records. Information about you will be stored in locked file cabinet and computer files protected with a password. This consent form will be filed securely in an official area.

People who have access to your information include the Principal Investigator and research study personnel. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the Texas A&M University Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly. Information about you and related to this study will be kept confidential to the extent permitted or required by law.

Who may I Contact for More Information?
You may contact the Principal Investigator, Stacey Dewald, to tell her about a concern or complaint about this research at 979-845-2954 or sdewald@tamu.edu .

For questions about your rights as a research participant, to provide input regarding research, or if you have questions, complaints, or concerns about the research, you may call the Texas A&M University Human Subjects Protection Program office by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu.

What if I Change My Mind About Participating?
This research is voluntary and you have the choice whether or not to be in this research study. You may decide to not begin or to stop participating at any time. If you choose not to be in this study or stop being in the study, there will be no effect on your relationship with Texas A&M University.

By participating in the questionnaire you are giving permission for the investigator to use your information for research purposes.

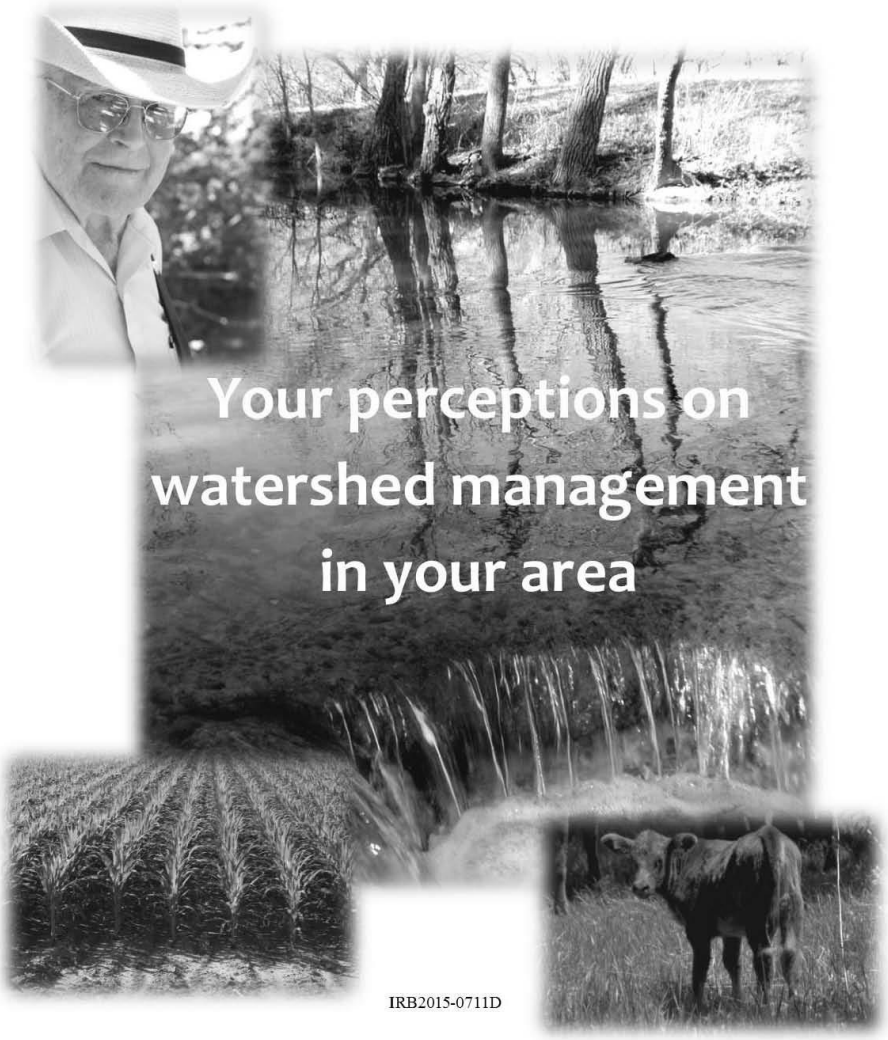
Thank you,

Stacey Dewald
Graduate Student
Texas Water Resources Institute

IRB NUMBER: IRB2015-0711D
IRB APPROVAL DATE: 04/04/2016
IRB EXPIRATION DATE: 11/15/2016

TEXAS A&M AGRILIFE

Texas Water Resources Institute
make every drop count



IRB2015-0711D

IRB NUMBER: IRB2015-0711D
IRB APPROVAL DATE: 06/14/2016
IRB EXPIRATION DATE: 11/15/2016

In the box below, please provide the numbers to your street address or PO Box address (e.g., 1234 Aggie Road). If you decide not to participate, please enter your address and return the questionnaire. Your name will be removed from the mailing list. Note that this is confidential and only used to ensure results are not duplicated.

Section 1: Production Characteristics

1. Please select the following statement that most applies to your land management/ownership.
   - ○ I own land in the area and produce agricultural commodities on it
   - ○ I own land but DO NOT produce agricultural commodities on it
   - ○ I own land in the area but lease it to someone else
   - ○ I lease land in the area and produce agricultural commodities on it
   - ○ I DO NOT own land in the area
   - ○ Other (please describe) _____

2. Of the land you manage/own, about how many acres fall under the following categories?
   Please input the amount of acres for each category. If you don't have acres in a category, please enter 0.
   - ☐ Self-owned
   - ☐ Leased from an individual who lives in the area
   - ☐ Leased from an individual who DOES NOT live in the area
   - ☐ Other (please describe) _____

3. On the land of which you manage/own, what percentage is for the following? (e.g., 70% livestock, 30% hay, total: 100%).
   Please input the percentages for each category. If you do not produce one of the commodities, please enter 0.
   - ☐ Row crops
   - ☐ Hay
   - ☐ Wildlife
   - ☐ Livestock
   - ☐ Other (please describe) _____

IRB NUMBER: IRB2015-0711D
IRB APPROVAL DATE: 06/14/2016
IRB EXPIRATION DATE: 11/15/2016

4. Approximately what percentage of your household net income comes from agricultural commodities?

- ○ 0%
- ○ 1–20%
- ○ 21–40%
- ○ 41–60%
- ○ 61–80%
- ○ 81–100%

5. Approximately how many years have you been in an agriculture operation?

- ○ 1–10 years
- ○ 11–25 years
- ○ 26–40 years
- ○ 41–60 years
- ○ 61+ years

Section 2: Water quality

6. In your opinion…

How important is water quality in your area?	Very important ○	Important ○	Not important ○
What is the CURRENT status of water quality in your area?	Above average ○	Average ○	Below average ○
How do you see the FUTURE of water quality in your area?	Improving ○	Staying the same ○	Deteriorating ○

7. Please indicate your **level of concern** regarding surface water in the following statements.

	Very concerned	Concerned	Slightly concerned	Not concerned
Drought	○	○	○	○
Pollution	○	○	○	○
Not enough restoration efforts	○	○	○	○
Stream bank erosion	○	○	○	○
Flooding	○	○	○	○
Sedimentation	○	○	○	○
Other (Please describe) _____	○	○	○	○

Section 3: Best management practices

For the following questions, please refer to the following definitions:

- **Best management practices**: effective methods of managing your property to achieve quality use and production of your land and mitigate environmental pollution (e.g., buffer strips, rotational grazing, etc.)
- **Incentive programs**: financial funding provided to landowners who contract with agencies to implement best management practices

8. Before you received this survey, were you aware of the term best management practice?

○ Yes

○ No

9. Are you aware of efforts to control sources of water pollution through best management practices?

○ Yes

○ No

10. Before you received this survey, were you aware of the term incentive programs?

○ Yes

○ No

11. This is a three part question: **FIRST** indicate familiarity with the following best management practices, **SECOND** indicate if you have implemented the practice, **THIRD** indicate the success of the practice to accomplish the environmental goal.

	How familiar are you?			**Have you implemented the practice?**		**How successful was the practice?**		
	Not at all familiar	Somewhat familiar	Very familiar	Yes	No	Not at all successful	Somewhat successful	Very successful
Soil testing	O	O	O	O	O	O	O	O
Riparian management	O	O	O	O	O	O	O	O
Nutrient management	O	O	O	O	O	O	O	O
Pesticide management	O	O	O	O	O	O	O	O
Variable rate application technology	O	O	O	O	O	O	O	O
Retaining crop residue on soil surface	O	O	O	O	O	O	O	O
Conservation tillage (no-till, strip-till)	O	O	O	O	O	O	O	O
Fencing around riparian areas for rotational grazing	O	O	O	O	O	O	O	O
Approved grazing management plan for livestock	O	O	O	O	O	O	O	O
Terraces	O	O	O	O	O	O	O	O
Wildlife management program	O	O	O	O	O	O	O	O
Other (please describe) _____	O	O	O	O	O	O	O	O

12. Have you used any of the following incentive programs?

	Yes	No
Water Quality Management Plan (WQMP (TSSWCB)	O	O
Environmental Quality Incentives (EQIP) (USDA-NRCS)	O	O
Conservation Reserve program (CRP) (USDA-FSA)	O	O
Landowner Incentive Program (LIP) (TPWD)	O	O
Other (Please describe) _____	O	O

13. Please indicate your **level of agreement** regarding the factors that influence your adoption of best management practices.

	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree
Cost-share programs to off-set the cost of implementing practices	○	○	○	○	○
Loans to help ease the cost of implementing practices	○	○	○	○	○
Improve/maintain the environment for future generations	○	○	○	○	○
How economically profitable the practice is	○	○	○	○	○
Seeing other landowners be successful in implementing practices	○	○	○	○	○
Pride of conserving your land by implementing practices	○	○	○	○	○
Personal recognition of implementing practices	○	○	○	○	○
How relatable the practice is to my current management situation	○	○	○	○	○
Improving wildlife/fish habitat	○	○	○	○	○
Improving scenic beauty of my land	○	○	○	○	○
Increasing property value of my land	○	○	○	○	○
Personal values and connection with the land	○	○	○	○	○
Concern for neighbors' land	○	○	○	○	○
Other (please describe) _____	○	○	○	○	○

14. Please indicate your **level of agreement** regarding the factors that have kept you from adopting best management practices.

	Strongly disagree	Disagree	Somewhat agree	Agree	Strongly agree
Initial cost of implementation	○	○	○	○	○
Maintenance costs	○	○	○	○	○
Incentive (cost-share) levels are too low	○	○	○	○	○
Uncertain if the practice will increase or decrease production profits	○	○	○	○	○
Terms of the program contract	○	○	○	○	○
Unsure of government regulations and rules associated with implementing practices	○	○	○	○	○
Lack of opportunities to see demonstrations of the practices	○	○	○	○	○
Lack of information about how effective the practice is	○	○	○	○	○
Belief that adopting a practice will not make a difference	○	○	○	○	○
My land does not meet the requirements of the practices	○	○	○	○	○
I did not know about incentive programs	○	○	○	○	○
Lack of support from agencies/organizations when implementing practices	○	○	○	○	○
Unsure of what my neighbors would think	○	○	○	○	○
I do not want to change my current land management practices	○	○	○	○	○
Other (please describe) _____	○	○	○	○	○

Section 4: Communication

15. This is a two part question: **FIRST** indicate if you currently receive water-related information using the following communication channels, **SECOND** indicate how you prefer to receive water-related information using the following communication channels.

	Do you currently receive information through this communication channel?		**How do you prefer to receive information through this communication channel?**				
	Yes	No	Least preferred	Slightly not preferred	No preference	Slightly preferred	Most preferred
Television	O	O	O	O	O	O	O
Newspaper	O	O	O	O	O	O	O
Direct mailings (e.g., newsletters, brochures/fliers)	O	O	O	O	O	O	O
Email	O	O	O	O	O	O	O
Magazines	O	O	O	O	O	O	O
Radio	O	O	O	O	O	O	O
Books	O	O	O	O	O	O	O
Websites	O	O	O	O	O	O	O
Social media (e.g., Facebook, Twitter, etc.)	O	O	O	O	O	O	O
Other (please describe) _____	O	O	O	O	O	O	O

16. Please indicate **how frequently** you would like to receive water-related information?

	Monthly	Quarterly	Twice annually	Annually	Never
Television	O	O	O	O	O
Newspaper	O	O	O	O	O
Direct mailings (e.g., newsletters, brochures/fliers)	O	O	O	O	O
Email	O	O	O	O	O
Magazines	O	O	O	O	O
Radio	O	O	O	O	O
Books	O	O	O	O	O
Websites	O	O	O	O	O
Social media (e.g., Facebook, Twitter, etc.)	O	O	O	O	O
Other (please describe) _____	O	O	O	O	O

17. This is a two part question: **FIRST** indicate if you currently receive water-related information from the following sources, **SECOND** indicate how trustworthy the source is to you.
Note- You may still answer "no" and still indicate how trustworthy the source is.

	Currently receive information from this source?		**How trustworthy is the source?**			
	Yes	No	Not trustworthy	Somewhat trustworthy	Trustworthy	Very trustworthy
Government agencies (e.g., Natural Resources Conservation Service, Farm Service Agency, Conservation Districts, etc.)	○	○	○	○	○	○
Industry groups (e.g., Texas Farm Bureau, Cattle Raisers Assoc., Cotton Growers, etc.)	○	○	○	○	○	○
Agricultural service providers (e.g., chemical company representatives, crop insurance agents, etc.)	○	○	○	○	○	○
Environmental groups (e.g., Sierra Club, Wildlife Society, etc.)	○	○	○	○	○	○
Texas Parks and Wildlife	○	○	○	○	○	○
Texas A&M AgriLife Extension	○	○	○	○	○	○
Trade Shows/Fairs	○	○	○	○	○	○
County Health Department	○	○	○	○	○	○
Friends and Neighbors	○	○	○	○	○	○
Other (please describe) _____	○	○	○	○	○	○

18. Please indicate the type of information you are interested in receiving.

	Not interested	Somewhat interested	Interested	Highly interested
How water quality impacts your operation	○	○	○	○
How agricultural production impacts your water quality	○	○	○	○
Current water quality levels (e.g., nutrients, salinity, etc.)	○	○	○	○
Specific conservation practices that improve water quality	○	○	○	○
How landowners can improve their operation by adopting water conservation practices	○	○	○	○
Updates on conservation practice effectiveness	○	○	○	○
How to install/maintain conservation practices	○	○	○	○
Fertility application methods that are conscious of water	○	○	○	○
How practices will improve/profit your land	○	○	○	○
Policies related to water	○	○	○	○
Pesticide/fertilizer application management	○	○	○	○
Other (please describe) _____	○	○	○	○

19. Please indicate your **level of need** regarding the following types of educational opportunities.

	Not needed	Somewhat needed	Needed	Very needed
How water quality impacts your operation	○	○	○	○
How agricultural production impacts your water quality	○	○	○	○
Current water quality levels (e.g., nutrients, salinity, etc.)	○	○	○	○
Specific conservation practices that improve water quality	○	○	○	○
How landowners can improve their operation by adopting water conservation practices	○	○	○	○
Updates on conservation practice effectiveness	○	○	○	○
How to install/maintain conservation practices	○	○	○	○
Fertility application methods that are conscious of water	○	○	○	○
How practices will improve/profit your land	○	○	○	○
Policies related to water	○	○	○	○
Pesticide/fertilizer application management	○	○	○	○
Other (please describe) _____	○	○	○	○

20. Please use the space below for any additional comments or thoughts about water-related topics in your area.

Section 5: Landowner Characteristics

21. What is your gender?
- ○ Male
- ○ Female

22. What ethnicity do you associate with?
- ○ American Indian
- ○ Asian
- ○ Black or African American
- ○ Native Hawaiian or Pacific Islander
- ○ Spanish, Hispanic, Latino
- ○ White or Caucasian

23. What year were you born? (e.g., 1964)

24. What is the highest level of education you have completed?
- ○ Less than high school
- ○ High school diploma/GED
- ○ Some college
- ○ 2 year degree
- ○ Bachelor's degree
- ○ Graduate degree
- ○ Other (please describe) _____

Thank you for participating in this study. We appreciate your time and commitment to answering the questions.

Please be sure to put the completed survey in the return envelope and place in the mail.

Thank you!

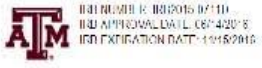
July 2016

Greetings. A couple of weeks ago I sent you a questionnaire seeking your opinion about watershed management practices and water-related information. To the best of our knowledge, we have not received the questionnaire.

If you have already completed and returned the questionnaire to me, thank you. We appreciate your effort in answering the questions. Your efforts will impact the way water-related information is delivered to landowners in your region.

If you have not completed and returned the questionnaire, please do so. Your answers will help me understand opinions related to watershed management practices. If you did not receive a questionnaire or you have misplaced it, you can complete the questionnaire online at **littleriver.tamu.edu/evaluation** or email me at sdewald@tamu.edu to receive another questionnaire.

Sincerely,
Stacey Dewald
Graduate Student, Texas Water Resources Institute
sdewald@tamu.edu



TEXAS A&M AGRILIFE RESEARCH | EXTENSION

TEXAS A&M UNIVERSITY
AGRICULTURE & LIFE SCIENCES

TEXAS WATER RESOURCES INSTITUTE

July 2016

Greetings,

A few weeks ago a questionnaire was sent to you asking your perceptions about adopting watershed management practices and your preferences for receiving water-related information. Many landowners in your area have returned the questionnaire, and results are being compiled to inform water educators on how to best deliver water-related information.

I am writing again because your response is important for accurate results. We want to ensure the results of this study are truly representative of those in your area; thus, your contribution is appreciated. If you prefer to complete the questionnaire online, feel free to do so at **littleriver.tamu.edu/evaluation**.

Few people have written to say they should not have received the questionnaire because they do not participate in agricultural production or do not live in Bell, Milam, or Falls counties. If either of these apply to you, please let us know by writing the numbers of your address on the questionnaire and returning it to us so we can delete your name from our list.

Additionally, the list of names associated with this study will be destroyed so individual names cannot be connected to the results. Protecting the confidentiality of your answers is important to us.

We hope you will fill out the questionnaire and return it in the enclosed prepaid envelope by **August 8, 2016**. Your opinion and contribution will provide beneficial watershed educational information to your area. Your effort is greatly appreciated. Thank you again for your time.

Sincerely,

Stacey Dewald
Graduate Student, Texas Water Resources Institute
sdewald@tamu.edu

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